

500W LINEAR AMPLIFIER

TYPE TA.1813

BERYLLIUM OXIDE - SAFETY PRECAUTIONS

INTRODUCTION

The following safety precautions are necessary when handling components which contain Beryllium Oxide. Most RF transistors contain this material although the Beryllium Oxide is not visible externally. Certain heatsink washers are also manufactured from this material.

PRACTICAL PRECAUTIONS

Beryllium Oxide is dangerous only in dust form when it might be inhaled or enter a cut or irritation area. Reasonable care should be taken not to generate dust by abrasion of the bare material.

Power Transistors

There is normally no hazard with power transistors as the Beryllium Oxide is encapsulated within the devices. They are safe to handle for replacement purposes but care should be exercised in removing defective items to ensure that they do not become physically damaged.

They MUST NOT:

- (a) be carried loosely in a pocket, bag or container with other components where they may rub together or break and disintegrate into dust,
- (b) be heated excessively (normal soldering is quite safe),
- (c) be broken open for inspection or in any way abraded by tools.

Heatsink Washers

Heatsink washers manufactured from Beryllium Oxide should be handled with gloves, cloth or tweezers when being removed from equipment. They are usually white or blue in colour although sometimes difficult to distinguish from other types. Examples of washers used are 917796, 917216 and 700716.

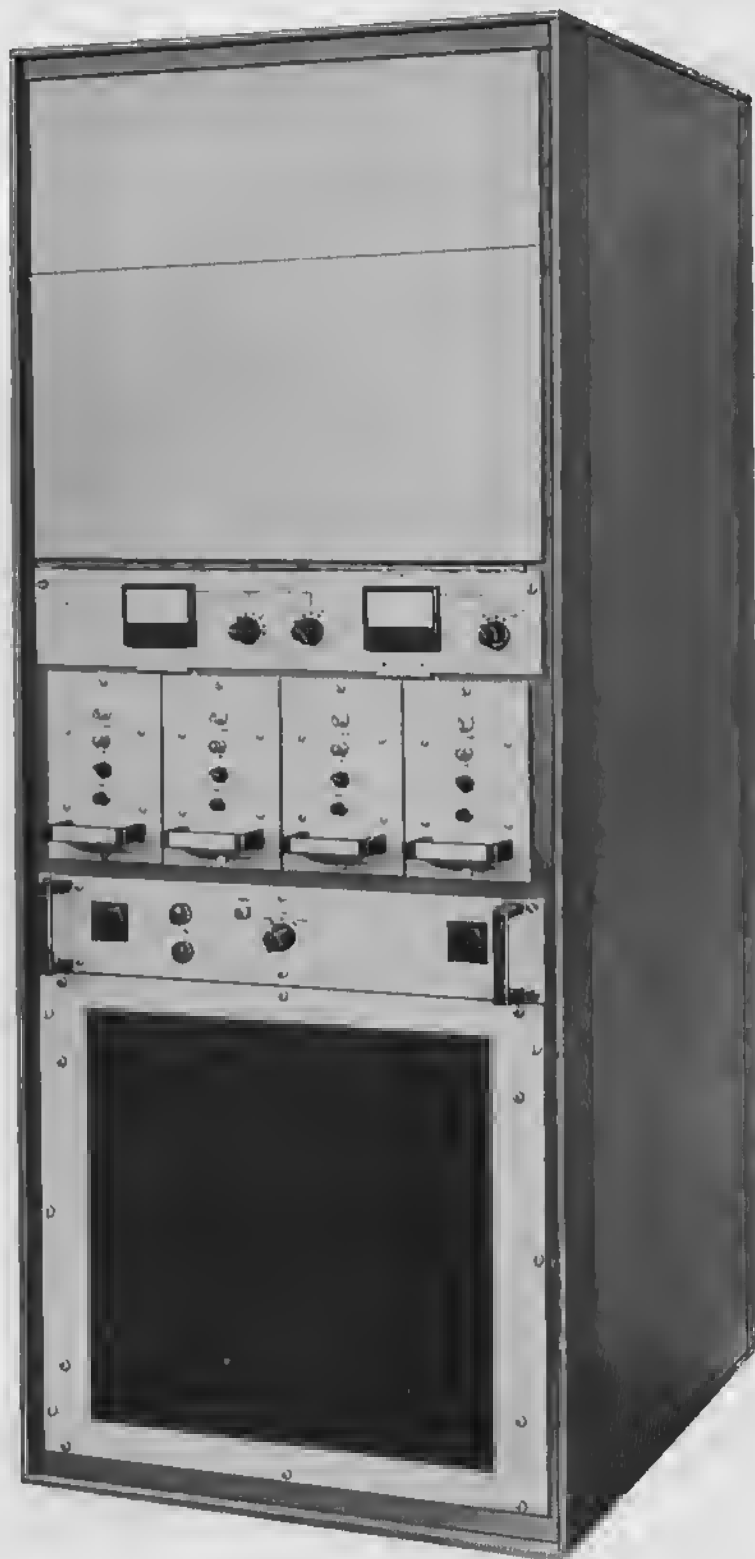
They MUST NOT:

- (a) be stored loosely,
- (b) be filed, drilled or in any way tooled,
- (c) be heated other than when clamped in heatsink application.

DISPOSAL

Defective and broken components must not be disposed of in containers used for general refuse. Defective components should be individually wrapped, clearly identified as "DEFECTIVE BERYLLIA COMPONENTS" and returned to the Equipment Manufacturer for subsequent disposal.

Broken components should be individually wrapped and identified as "BROKEN BERYLLIA COMPONENTS". They must not be sent through the post and should be returned by hand.



Linear Amplifier Type TA.1813

500W LINEAR AMPLIFIER TA.1813

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TECHNICAL SPECIFICATION

Frequency Range:	1.6 to 30.0MHz
Power Output:	500W \pm 1dB p.e.p. and C.W.
Output Impedance:	50 ohm (will operate at full power into 3:1 V.S.W.R. when operating with MA 1004 Feeder Matching Unit).
Intermodulation Products:	35dB below 1 tone 1.6 to 10MHz in a standard two tone test. 25dB below 1 tone 10.0 to 30MHz in a standard two tone test.
Harmonic Radiation:	Better than -43dB below p.e.p. when operating with MA1004 or MA1034 units.
Wideband Noise:	125dB below p.e.p. in 3KHz bandwidth - with drive unit muted.
Input Level:	25mW - 200mW nominal \pm 1.5dB over the frequency range.
Input Impedance:	50 ohm
Supply:	210-250V single phase 47-60Hz. Consumption 3KVA.

CHAPTER 1

GENERAL DESCRIPTION

INTRODUCTION

1. The TA.1813 is an all solid-state wideband linear amplifier which operates over the frequency range 1.6MHz to 30MHz. The output power (500W) is obtained by combining the 125W outputs of four identical plug-in modules in a passive combining network.
2. The amplifier, complete with power supplies etc. is mounted in a floor standing cabinet, the top section of which contains space for fitting associated drive equipments and filter/feeder matching units (para.5). The amplifier operates from a 210/250V single phase AC supply, and internal regulation (up to $\pm 6\%$) is provided, as are all necessary cooling and air filtering facilities.
3. Installation is extremely simple (see Chap.3). For fixed station operation it is not essential to bolt the cabinet to the floor, since it can be free standing if required, (see CAUTION on page 3-1). Alternatively the cabinet can be bolted permanently to the floor. Electrical connections i.e. audio, keying and AC supply are made to terminals in the bottom rear of the cabinet; the RF output connector is situated at the top rear.

ASSOCIATED EQUIPMENTS

4. The TA.1813 amplifier is designed to operate primarily with the Racal MA.1720 (Synthesized) or MA.7917 (Channalized) Transmitter Drive Units. It can, however, be used in conjunction with any HF drive unit with a nominal 100mW output over the required frequency range.
5. Connection to an external antenna should be made via one of two alternative units, dependent upon the type of antenna to be used, viz
 - (i) For operation into a wideband antenna, cut dipole, or any other antenna which will normally present a V.S.W.R. better than 3:1 at the operating frequency, the Racal Feeder Matching Unit Type MA.1004 is recommended. This is a fast-acting automatically-tuned unit which ensures maximum power transfer into the antenna at all frequencies, and at the same time provides a high degree of attenuation to harmonic frequencies.
 - (ii) When operating into a whip or long wire antenna with an associated aerial tuning unit, the Racal Filter Switching Unit (Type MA.1034) is required. This unit is a simpler device than the MA.1004, and provides harmonic attenuation; impedance matching is provided by the external A.T.U.
6. The TA.1813 cabinet assembly is designed to include, as required, any combination of drive unit (MA.1720 or MA.7917) and output filtering/matching unit (MA.1034 or MA.1004) thereby providing a self-contained, fully automatic, solid state H.F. transmitter.

7. The following table lists the units, modules and printed circuit (p.c.) boards which form the TA.1813 linear amplifier. Detailed technical descriptions are given in Chap. 5.

Prefix Codes

8. Prefix codes are given to each unit or module and to each board in a unit or module as listed below. As an example, the complete reference for resistor R1 of a board A in sub-unit No.5 is 5AR1. Prefix codes are shown encircled on illustrations.

PREFIX CODES

Prefix Code	Unit, Module or PC Board	Type No.	Quantity Used	Circuit Diagram Fig. No.
1	<u>Cabinet Assembly</u>	TA.1813	1	32
None	Containing			
None	Power Supply Module	MS64) 1 each	
	Power Supply Module	MS64) Two identical	25
) Modules	
2	<u>Control Panel</u>	MM377	1	30
None	<u>RF Power Module</u>	MM420	4	21 + 27
	Consisting of			
4	Stabilizer Module	MS440	4 (total)	27
	Containing			
4A	PC Board	PS313	4 (total)	27
5	RF Amplifier Module	MM320	4 (total)	21
	Containing			
5A	Low Level Board	PS351	4 (total)	13
5B	High Level Board	PS315	4 (total)	15
5C	Protection Board	PS251	4 (total)	19
5D	VSWR Board	PS316	4 (total)	17
6	<u>Combining Unit 500W</u>	MS126	1	23
	Containing			
6	PC Board	PS122	1	23
7	<u>Splitter Unit</u>	MS444	1	1
	Containing			
7	PC Board	PS318	1	1
8	<u>Distribution Amplifier</u>	MS240	1	3
	Containing			
8	PC Board	PS319	1	3
12	<u>Muting Unit</u>	MS564	1	34
	Containing			
12A	PC Board	PS565	1	34

1-2

Prefix Code	Unit, Module or PC Board	Type No.	Quantity Used	Circuit Diagram Fig. No.
9	<u>Overload Unit</u>	MS443	1	5
9	Containing PC Board	PS322	1	5
10	<u>Cabinet VSWR Unit</u>	MS447	1	7
10	Containing PC Board	PS317	1	7
11	<u>Meter Panel Assembly</u>	MS445	1	9
11A	Containing VSWR Warning PC Board	PS446	1	11

THE R.F. CIRCUITS

Fig. 1.2

9. A block diagram showing the RF path and the RF levels within the RF circuits is given in Fig. 1.2. The RF input from the associated transmitter drive unit is fed, via the muting unit, into the splitter unit which provides two outputs to the distribution amplifier. The distribution amplifier provides four buffered 50 ohm outputs with a nominal gain of 3dB from the input to each output. The four outputs are fed, via 50 ohm coaxial lines, to the inputs of the MM 420 RF Power Modules. The 125W output from each RF module is fed, via 50 ohm coaxial lines, to inputs on the combining units MS 126.
10. The module outputs are combined two at a time in hybrid stages. The first two hybrid stages each provide 250W outputs which are combined in a further hybrid stage to produce the 500W output. The two 250W outputs are available separately, at 50 ohm impedance, at a patch panel. During normal operation both outputs are connected to the final hybrid transformer to produce a combined output of 500W.
11. The gain characteristics of each module are maintained at similar values, via automatic level control circuits. In addition electrical path lengths, including coaxial cable lengths, are similar for each circuit. These provisions ensure that the phase and amplitude characteristics of each path are similar, thus allowing the combining unit to function at optimum efficiency.
12. The complete amplifier is wideband, therefore no tuning or moving parts are involved.
13. The output from the combining unit is normally fed via an MA.1004 or MA.1034 unit (see para.5) which, in turn, feeds the V.S.W.R. unit Type MS 447. The V.S.W.R. unit monitors the forward and reflected output power from the amplifier and provides visual indication on the meter and an external warning voltage should a pre-determined reflected output power level be exceeded.
14. The automatic level control circuits (para.11) also provide protection by automatically reducing power if a mismatch occurs at the module outputs.

15. The overload unit Type MS 443 (shown on Fig. 1.4) automatically monitors the operational state of the amplifier and provides an external signal if unbalanced RF inputs are fed to the combining unit, or if either MS64 power supply unit fails (see Chap. 5 for a detailed description).

POWER SUPPLY DISTRIBUTION

Figs. 1.3 and 1.4

16. Each 250W amplifier is provided with its own power supply which can be independently switched. Each power supply consists of a DC power supply unit Type MS64 whose outputs provide DC supplies to a pair of RF modules. Associated with each RF module is a Stabilizer Module MS 440 which forms part of the Type MM 420 Amplifier. Each MS 440 module provides a stabilized DC output to each RF module, and includes a fast current trip circuit to protect the RF circuits if an overload occurs. The DC voltage and the current taken by each module can be monitored on the amplifier meter panel.

OPERATIONAL FEATURES

Active Standby Philosophy

17. The 500W amplifier TA.1813 consists basically of two 250W amplifiers, each comprising two 125W RF modules. Each 250W amplifier is mechanically and electrically independent of the other; at the final hybrid stage of the combining unit the two 250W outputs are combined to give 500W. The final hybrid stage can be by-passed by external patching, allowing one amplifier to continue to function and provide a 250W output, regardless of the condition of the second 250W amplifier.

18. The operational flexibility of the two 250W amplifiers is increased by using four independent RF modules each providing 125W output. As the outputs of the modules are combined, (not paralleled) they are isolated from each other electrically. Therefore, one operational module is not affected by a defective module even if the defect is a short-circuit, open circuit or any other fault condition. In addition, a defective module can be unplugged and replaced while the remainder of the modules continue to operate. The only effect on transmission due to a defective module will be small reduction in output power (of the order of 1.75dB).

19. This extremely important feature together with the ability to transmit temporarily with only one 250W amplifier in use (para. 17) ensures an overall equipment reliability very much greater than that obtained using conventional transmitters, giving a "lost transmission time" due to faults that is extremely small.

20. It should be noted that when a failure of one 250W amplifier occurs the radiated power is reduced from 500W to 125W until the output connector is transferred (patched) to the still functioning 250W outlet. Until patching is carried out 125W is dissipated internally in the combiner (which is continuously rated) allowing only 125W to appear at the output. Patching for 250W output can be carried out at a suitable break in transmission; approximately 30 seconds is required for this operation.

Operating Indicators on Modules

21. Each module can be switched off separately at its own front panel. The operating state of each module is indicated by two front-panel lamps. The illumination of the green lamp shows the presence of the D.C. supply; the white lamp illuminates when the module is providing an RF output. A faulty or weak module is indicated by a lower level of illumination when compared with the remainder of the indicator lamps.

Metering and Monitoring

22. The Metering panel (MS 445) allows metering of the 30V and 20V DC supply voltages and current of the 30V supply to each module. In addition the input RF power level and the forward and reflected output power levels are indicated. Front panel monitoring is provided for all module outputs, each 250W output and the 500W output, via 50 ohm BNC connectors.

NOTE: Only positions 1 to 4 of switch SA on the panel are connected in circuit.

COOLING

23. Forced air cooling is built into the amplifier cabinet. Two similar blowers are fitted at the bottom of the cabinet for cooling the RF modules, a third is located at the top rear of the cabinet and provides general cooling for the units fitted at the top of the cabinet. The total air flow from each blower fitted to the base of the cabinet is approximately 220cfm at 1.3W.G.

24. When the standard version of the cabinet is used air is taken in from the front via the filter panel which covers the power supply units at the bottom of the cabinet, and is exhausted at the rear of the cabinet. When a ducted system (to special order) is required the air filter is fitted at the rear of the cabinet and inlet and outlet ducting are bolted to the rear cabinet skin.

25. The air flow is not interlocked with the electrical system since all RF modules are individually protected against overheating. The RF modules will operate for a considerable period of time (dependent on ambient temperature) with both blowers inoperative. This means that the equipment can be operated satisfactorily for several minutes with a module removed and a consequent loss of air through the gap created.

POSITION FOR DRIVE OR
EXCITER UNIT

POSITION FOR FEEDER
MATCHING UNIT OR
FILTER SWITCHING UNIT

METER PANEL MS445
(COMBINING UNIT MS126
MOUNTED BEHIND METER PANEL)

RF POWER MODULES MM420
(4 OFF) (EACH CONSISTING OF
MM320 RF MODULE WITH MM440
STABILIZER MODULE MOUNTED
AT REAR)

CONTROL PANEL MM377
(CARRYING CIRCUIT BREAKERS
OFF/ON/REMOTE SWITCH ETC.)

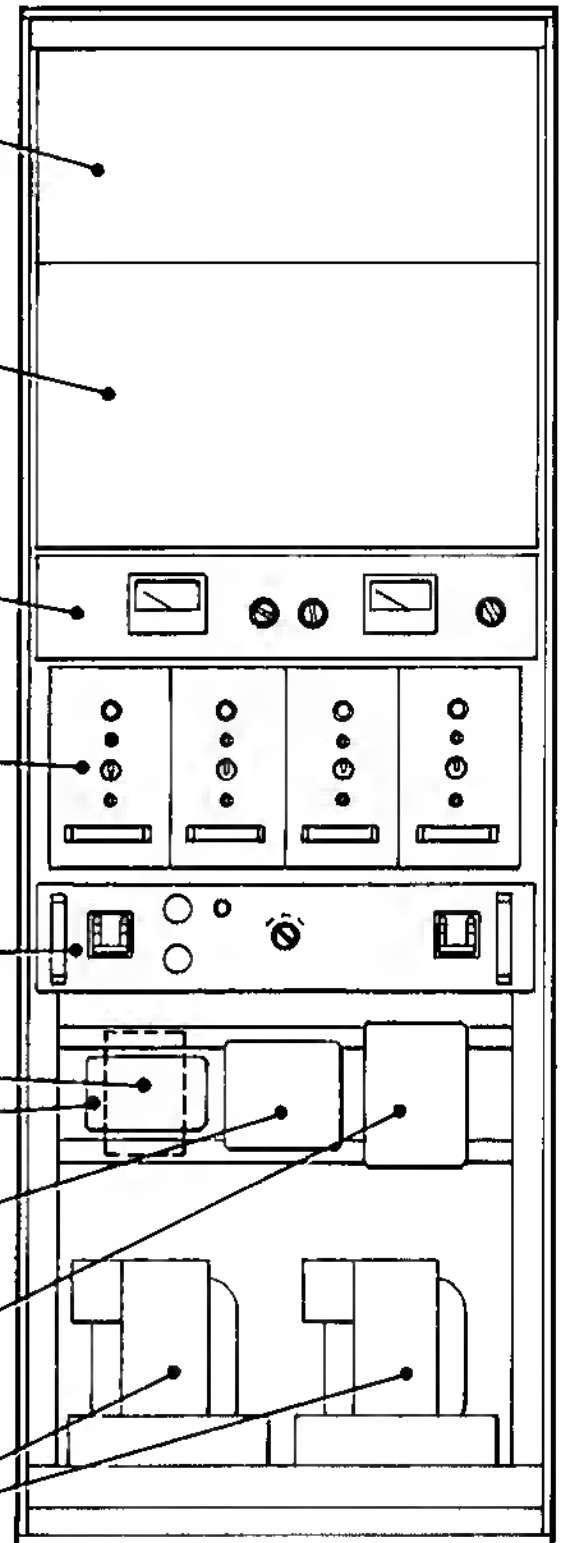
MUTING UNIT MS564

SPLITTER UNIT MS444

DISTRIBUTION AMPLIFIER MS240

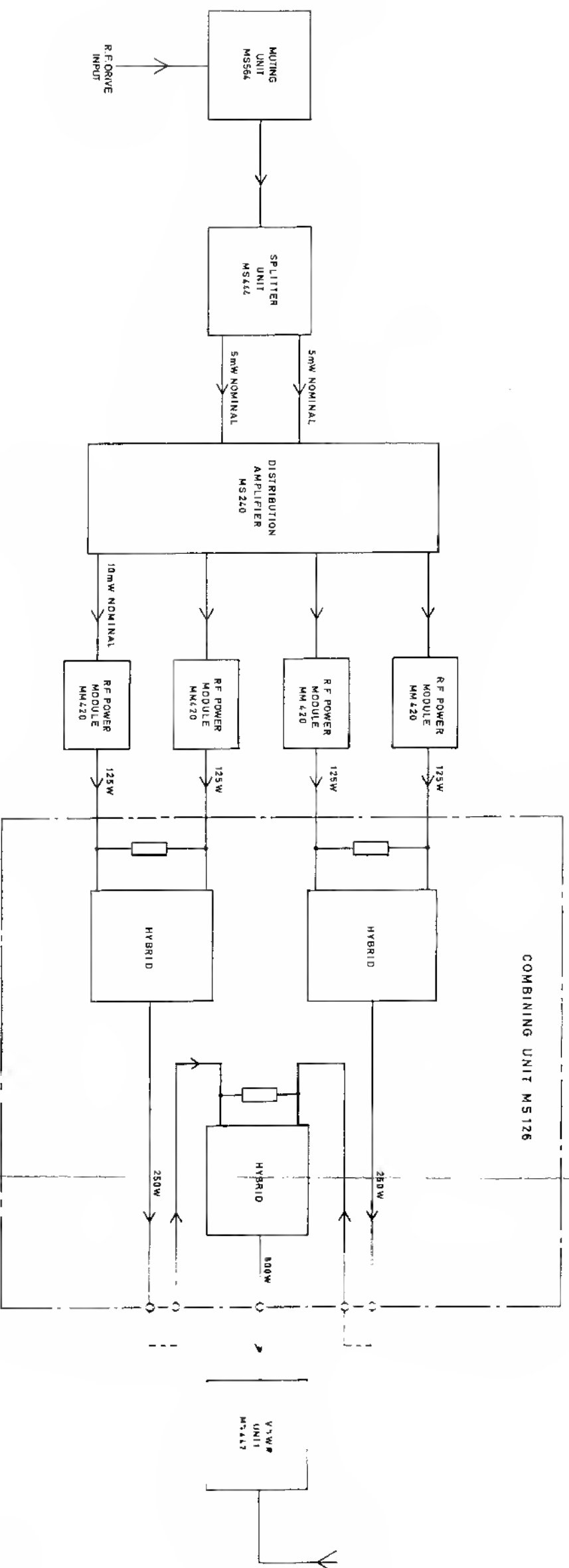
OVERLOAD UNIT MS443

POWER SUPPLY MS64 (2)



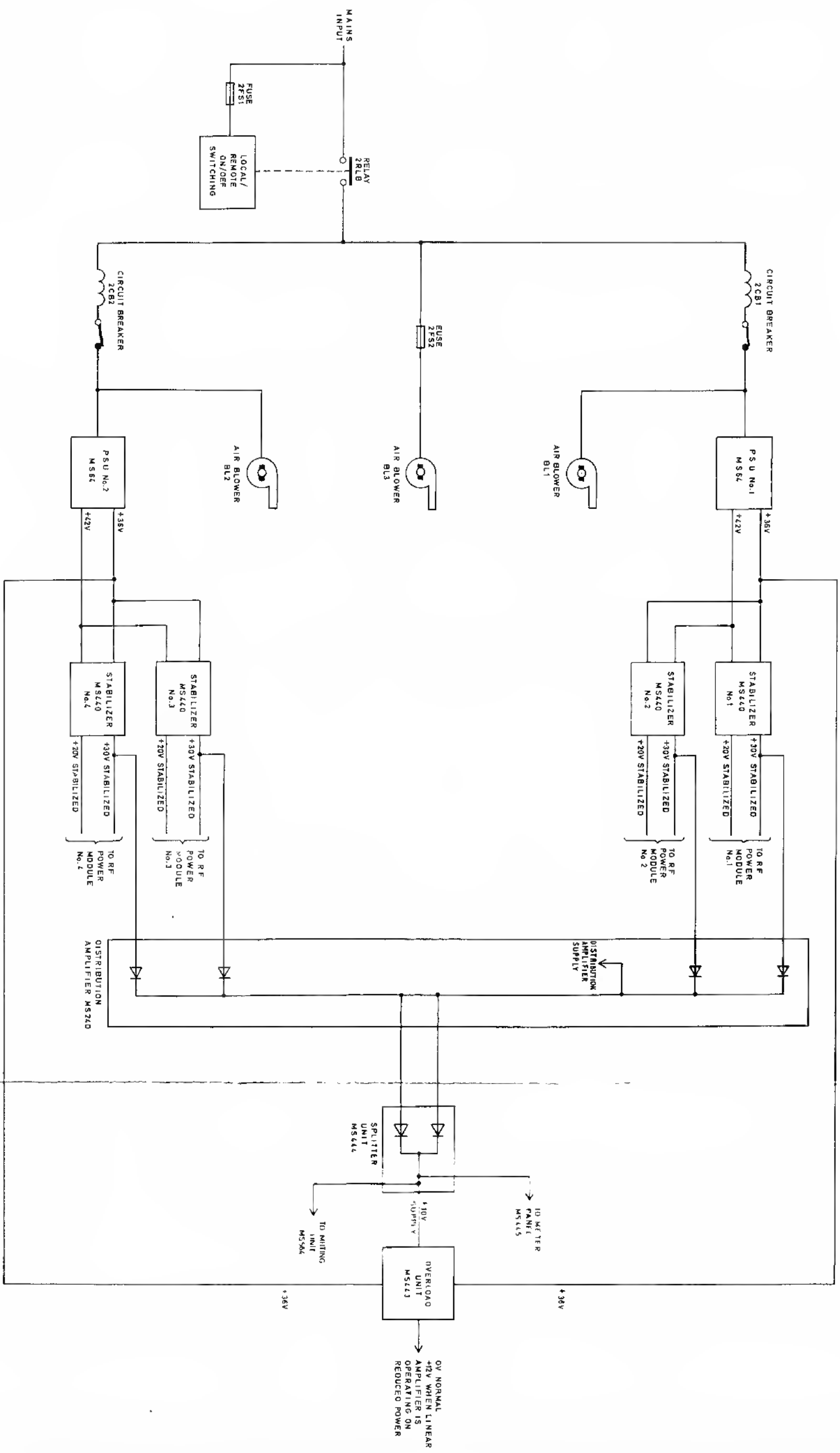
VIEW WITH POWER SUPPLY
PANEL REMOVED

NOTE: SEE ALSO FIG.33



Block Diagram: Linear Amplifier Type TA.1813

Fig.1.2



TA.1813 Block Diagram: Power Supply Distribution

Fig.1.3

CHAPTER 2

SETTING-UP AND OPERATING INSTRUCTIONS

INTRODUCTION

1. It is assumed that the installation procedure described in Chapter 3 has been carried out, i.e. all units are mounted within the cabinet assembly, and all external wiring connections made in accordance with the appropriate system handbook. Initially, the Setting-up Procedure given in paras.3 to 5 should be carried out in conjunction with the Operating Procedure.

OPERATING PROCEDURE

2. Switching on is achieved as follows:-
 - (i) Set the amplifier control switch to ON for 'local' operation, or to REMOTE.
NOTE: When REMOTE is selected the amplifier is switched on from an external source by a 12V line. Switching is normally carried out from the MA.1720 drive unit when this unit is fitted.
 - (ii) Check that the blower at the top of the cabinet operates when ON is selected.
 - (iii) Set the two front panel circuit breakers on the TA.1813 to ON. This immediately energizes the blowers and switches on all the supplies to the overall amplifier. In this condition the individual RF modules are not muted. To externally mute them it is necessary to apply an external earth connection to TB9 pin 10.
 - (iv) Switch ON all the RF modules via their respective front panel switches, and note that all green lights are illuminated.
 - (v) Check that the 20V and 30V supplies are present at all modules as indicated on the appropriate meter. Monitor the individual module currents on the switched meter, and ensure they all indicate approximately equal values when an RF output is being supplied.

NOTE: Only positions 1 to 4 of the meter switch are used.

SETTING-UP PROCEDURE

3. Ensure that the Splitter Unit attenuators are set to 0dB (i.e. SK1 linked to pin 13; pin 10 linked to pin 9).
4. Terminate the RF output connector on the TA.1813 with a 500W, 50 ohm resistive load.
5. Feed in a CW drive signal, in the frequency range 1.6 to 30MHz, to PL28. Adjust the drive level, in conjunction with the Muting Unit attenuators, for an input power

of 25mW as monitored on the Meter Panel. Refer to the table below for the Muting Unit attenuator settings:

Pins linked on Muting Unit	Attenuation
8 and 10 14 and 13	0dB
8 and 11 15 and 13	3dB
8 and 9 12 and 13	6dB
8 and 11 15 and 9 12 and 13	9dB

6. Ensure that the clear lamps on the four RF modules are glowing at approximately equal brightness.
7. Monitor module currents at the front panel meter and ensure that they all indicate approximately 12A and that in no case is 15 amps exceeded. Currents will be lower at the LF end of the band, and highest at midband, but at any one frequency setting, individual module currents should be similar.
8. Switch-off, disconnect dummy load and connect antenna.
9. For system operation refer to the appropriate system handbook.

250W RF Output

10. If it is required to operate the TA.1813 as two separate 250W amplifiers, i.e. for maintenance purposes, the following procedure should be adopted.
 - (1) Set the control switch to OFF.
 - (2) Switch off the circuit breaker on the power supply feeding the modules not required for traffic i.e. 2CB1 for RF Modules Nos.1 and 2, or 2CB2 for RF Modules Nos.3 and 4.

NOTE: 2CB1 is the left hand circuit breaker, 2CB2 is the right hand.

- (3) Remove the front panel of the Power Supply, by undoing eight quick-release fasteners.

- (4) Disconnect 7 PL2 from 8SK5 of the distribution amplifier if RF Modules Nos. 1 and 2 are to be removed from service, or disconnect 7PL3 from 8SK6 if RF Modules Nos. 3 and 4 are to be removed from service.
- (5) Connect the plug, disconnected in operation (4), to the Dummy Load socket 1SK29 which is located on the hinged mounting plate.
- (6) Lower the meter panel to its fullest extent by removing the retaining arm and allowing the meter panel to rest gently on its hinges.
- (7) Disconnect the output lead from the 500W output.
- (8) Disconnect the output lead from the required 250W output and use the Combiner Patch Lead Assembly 8A604047 supplied with Accessory Kit CA.607, to connect the required 250W output to the output lead disconnected in (7).

NOTE: This is important to maintain the pre-programmed line selection when the linear amplifier is used in pre-programmed systems e.g. with the MA.7917 Exciter or the MA.1034A Filter Switching Unit.

- (9) Switch on the amplifier and operate normally.
- (10) The other half of the amplifier may be operated for test purposes by connecting a dummy load to the 250W RF output socket and a Signal Generator to the appropriate Distribution Amplifier input socket.

CHAPTER 3

INSTALLATION

GENERAL

1. The equipment is shipped with the RF modules and the power supply units packed separately. Unpacking and fitting instructions are given in paras. 8, 9 and 10.

FLOOR MOUNTING

2. The cabinet is provided with floor standing fitments and need not be permanently fixed to the floor. If a permanent fixing is intended, the feet provided should be removed and the base screwed to the floor.

CAUTION: When the cabinet is not fixed to the floor not more than one power unit should be removed at a time to prevent toppling of the cabinet.

MAIN EARTH

3. An earth strap should be connected between the earth point in the base of the cabinet and the main station earthing system.

POWER AND SIGNAL CONNECTIONS

Mains Supply

4. A single phase supply of 3kVA maximum is required. Line, neutral and earth connections are made in the rear of the cabinet at the bottom (TB1 Pins 1, 2 and 3 respectively). Each MS64 Power Supply has an individual mains selector plug. This should be set to the voltage appropriate to the incoming mains supply.

Antenna Connection

5. This is made to the RF output connector (Type C) at the top rear of the cabinet. UR 102 (50 ohm) cable is recommended.

Audio and Keying Inputs

6. These connections to the associated drive unit (if fitted) should be made to TB16 at the bottom of the cabinet in accordance with the following table, using the fanning strips provided.

NOTE: For further information refer to the associated System Handbook.

TABLE OF AUDIO/KEYING CONNECTIONS

<u>TB16 pin</u>	
1)	Audio 1
2)	
3	Screen
4)	Audio 2
5)	
6	Screen
7)	Key
8)	Earth
9)	TSK
10)	Earth
11	Not Used
12	Earth

Miscellaneous External Connections

7. Interconnections required between the TA.1813 and units such as the MA.1720 Drive Unit and the MA.1004 Feeder Matching Unit will be found in the associated System handbook.

FITTING THE RF MODULES

8. The four RF modules are packed in pairs. Carefully unpack them and slide one into each of the four compartments in the cabinet. Signal and power connectors on the rear of the RF modules will mate with fixed connectors at the rear of the cabinet as the modules are slid into position. Secure each module with the two quick-release fasteners attached to the front panels.

FITTING THE POWER SUPPLY UNITS

9. The two power supply units are packed in a specially strengthened case. Before unpacking them, study carefully the illustrated unpacking instructions attached to the packing case.

NOTE: Failure to observe these instructions may result in the units being damaged.

10. To fit the power supply units into the cabinet proceed as follows:-
- (1) Remove the power supply panel from the front of the cabinet by releasing the eight quick-release screws.
 - (2) Remove the two screws which secure each power supply unit mounting tray to the cabinet, and withdraw the trays.

- (3) Bolt each power unit to a mounting tray, using the six Pozidriv screws provided.
- (4) Slide the trays with power supplies into the cabinet and bolt into place with two screws.
- (5) Connect the cable harness to the power supply units as follows:

Cable with red or orange sleeve	+ve 36V terminal
Cable with black sleeve	-ve 36V terminal
Orange leads	+ve 42V terminal
Green leads	E terminal
Blue leads	N terminal
Brown leads	L terminal
- (6) Clamp the cables to the front of the power supply units using a 'P' clip at each unit.
- (7) Re-fit the power supplies panel to the cabinet.

CHAPTER 4

BRIEF TECHNICAL DESCRIPTION

INTRODUCTION

1. The following paragraphs briefly describe the function of the units and sub-units which constitute the TA.1813 Linear Amplifier; detailed technical descriptions are given in Chapter 5.

CONTROL PANEL MM377

2. The Control Panel carries the contactors and relay which control the a.c. power supply to the amplifier.

MUTING UNIT MS564

3. The Muting Unit provides muting of the r.f. drive signal to the Splitter Unit. On de-mute, it ensures that the r.f. drive level is restored at a controlled rate.

SPLITTER UNIT MS444

4. The Splitter Unit is a passive network providing two separate outputs of equal amplitude and phase to the Distribution Amplifiers. The RF input level is sampled at the Splitter Unit, and the output is fed to a metering circuit on the Meter Panel.

DISTRIBUTION AMPLIFIER MS240

5. The Distribution Amplifier provides four separate and isolated RF outputs to the four RF Power Modules. The unit contains four buffer amplifiers each with an approximate gain of 3dB.

OVERLOAD UNIT MS443

6. The overload unit provides a reduced power warning signal in the event of failure of a power supply or an RF Power Module. The unit also provides a 'fault' signal if either the main contactor fails or a fault signal is received from an associated unit, such as the MA.1004 Feeder Matching Unit.

CABINET VSWR UNIT MS447

7. The Cabinet VSWR Unit monitors the forward and reflected powers on the RF output feeder and provides d.c. outputs to the metering circuit on the Meter Panel MS445.

METER PANEL MS445

8. The Meter Panel contains two meters and associated switches to provide an indication of the voltages applied to, and the current drawn from the 30V supply, by each RF Power Module. The RF input power and the Forward and Reflected RF output power of each module is also indicated. The Meter Panel also contains a VSWR Warning Board which comprises a trip circuit operated by the VSWR Unit reflected power line. The trip circuit can be used to operate a fault line to a suitable external circuit.

RF POWER MODULE MM420

9. The RF Power Module Type MM420 is an all solid-state wideband linear amplifier capable of delivering at least 125 Watts over the frequency range of 1.6MHz to 30MHz.
10. The module consists of a basic RF Amplifier Type MM320 and a power stabiliser unit Type MM440. The two units consist of printed circuit boards mounted on finned castings which are bolted together in line to form a complete plug-in unit. When required they can be readily separated, for example, when replacing a faulty stabiliser unit.
11. Four complete modules (MM420) are used in the TA.1813 Linear Amplifier and each module plugs directly into the TA.1813 cabinet.

RF Amplifier Module MM320

12. The RF Amplifier Type MM320 consists of a Low Level Board and High Level Board which make up the basic RF amplifier together with two associated printed circuit boards, namely a VSWR Board and a Protection Board. A block diagram of the amplifier assembly is shown in Fig. 4.1 at the rear of this chapter whilst the inter-connection and physical location of the sub-units are shown in Figs. 21 and 22 respectively.

Low Level Board PS351

13. This board amplifies the input RF signal of 10mW nominal from the Distribution Amplifier to approximately 2W. In addition it provides a variable gain stage which is used as the automatic level control circuit to maintain the output RF level of the High Level Board constant and to reduce the output to a safe level when a load mismatch occurs.
14. The RF input to the Low Level Board is fed first to the Automatic Level Control (a.l.c.) stage consisting basically of two transistors operating in class A push-pull. The gain of the stage is varied by causing two diodes, connected in series, to partially conduct and shunt part of the RF drive in accordance with signals from detectors (para.26). The shunting effect controls the output of the stage.
15. Following the a.l.c. stage are two further class A amplifier stages. The first stage comprises two transistors operating in grounded base mode and connected in a push-pull configuration. The second stage is similar to the first but employs four transistors connected in a parallel/push-pull configuration and transformer coupled to the output.

High Level Board PS315

16. This board contains two stages of RF amplification. The drive stage consists of two power transistors operating in class B push-pull with grounded base. This stage is transformer coupled to the final PA stage which comprises 8 power transistors which are connected in a parallel push-pull arrangement and operated in a common emitter mode. Negative feedback is applied to the PA stage to ensure a flat response over the frequency range.

17. All components associated with the RF output amplifier, with the exception of the transistors and diodes, are mounted on the High Level Board. The transistors themselves are stud-mounted on the main casting to ensure maximum heat dissipation. Replacement of a transistor can be effected without removing the High Level Board (refer to Chapter 6).
18. The High Level Board includes diodes monitoring the RF collector voltage swing of the power transistors. If this becomes too large, the diodes conduct and operate the a.l.c. stage reducing the drive level to avoid saturation (refer to para. 14).

VSWR Board PS316

19. The Voltage Standing Wave Ratio Board monitors the forward and reflected output power of the High Level Board before it is fed to the RF output connector of the MM420.
20. The forward power detector is fed back to the a.l.c. stage on the Low Level Board to control the output level under normally matched conditions (i.e. 50 ohm). The actual forward output level is set by a potentiometer.
21. Under mismatched conditions, the resultant output from the reflected power detector is also fed back to the a.l.c. stage to reduce the output level appropriate to the degree of mismatch. The level at which the reflected power takes over from normal a.l.c. controls is adjustable via a second potentiometer.

WARNING

THE POTENTIOMETERS OF THE RF POWER MODULE MM420 SHOULD ONLY BE ADJUSTED WHEN SETTING UP THE MODULE AS PART OF THE ALIGNMENT PROCEDURE (CHAPTER 7 PARAGRAPH 14). THEY SHOULD NOT BE ADJUSTED WHEN THE MODULE IS INSTALLED IN THE TA.1813, SINCE THE PROTECTION AFFORDED TO THE OUTPUT TRANSISTORS WILL BE REDUCED WITH THE CONSEQUENT RISK OF TRANSISTOR FAILURE.

Protection Board PS251

22. The Protection Board is designed to provide protection for the RF amplifier against d.c. fault conditions. Depending on the actual fault, it operates in one of two ways.
- Firstly if a short circuit should occur on the Stabiliser Unit (MS440) this would apply approximately 40V to the Amplifier H.T. rail, overstressing the RF transistors. To prevent this a power thyristor is included which, in the event of such a fault, conducts and operates a fuse thereby open circuiting the positive supply.
 - Secondly, if the collector currents of the RF output transistors exceed a prescribed maximum (approximately 7 Amps for each group of four transistors) a fast acting d.c. overload signal is applied to the a.l.c. stage on the Low Level Board, to ensure this current level is not exceeded.

NOTE: If reducing the RF drive does not control the transistor currents then a d.c. overload trip in the stabiliser unit will operate.

COMBINING UNIT 500W MS126

23. The Combining Unit is a completely passive unit containing a series of hybrid combining transformers, impedance transformers and ballast load resistors.
24. The function of the unit is to accept the output of each RF Power Module and to combine their outputs into a common output line whilst providing RF isolation between any one module and the others.
25. As shown on the block diagram of the Unit, Fig. 4.2, the four RF inputs from the RF Power Modules are fed into hybrid transformers in pairs. The first two hybrid stages produce two 250W outputs. The two 250W outputs are combined to produce a 500W output. The final hybrid may be by-passed if it is required to provide a 250W output. (Chop. 1, para. 17 refers).

AUTOMATIC LEVEL CONTROL

26. Four separate detectors control the output level of the module via the Automatic Level Control (ALC) circuit, these are:-
 - (1) Forward Power Control - Normal operation into 50 ohms.
 - (2) Reflected Power Control - Operates to reduce the output of the module when working into a mismatch i.e. when the Reflected Power Level would be liable to damage the output stage.
 - (3) 'Swingometer' - This operates by monitoring the collector voltage swing of the output stages and under certain load impedances will reduce the output level to prevent the output transistors running into saturation.
 - (4) Current o.l.c. - Operates quickly to reduce the output of the module in the event of fast transients by sensing the current in each half of the output stage.

PROTECTION METHODS

27. In addition to a.l.c. protection each module is protected against over-heating by a thermostat whilst a voltage detecting circuit in conjunction with a fuse in the supply line provides protection against short circuits in the stabilizer. AC supply overload protection is provided for each power unit by circuit breakers on the Control Panel.

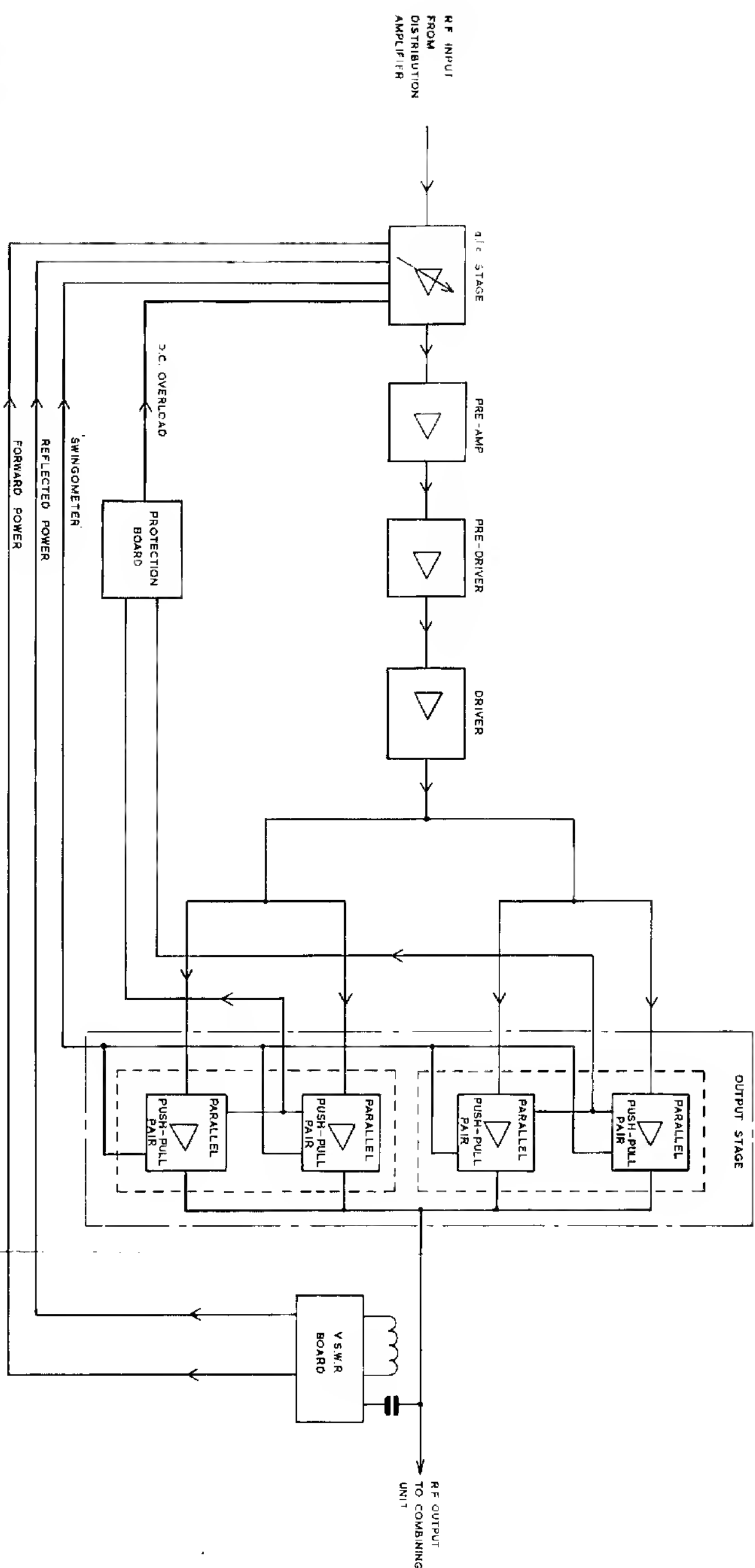
POWER SUPPLIES

Power Supply Unit MS64

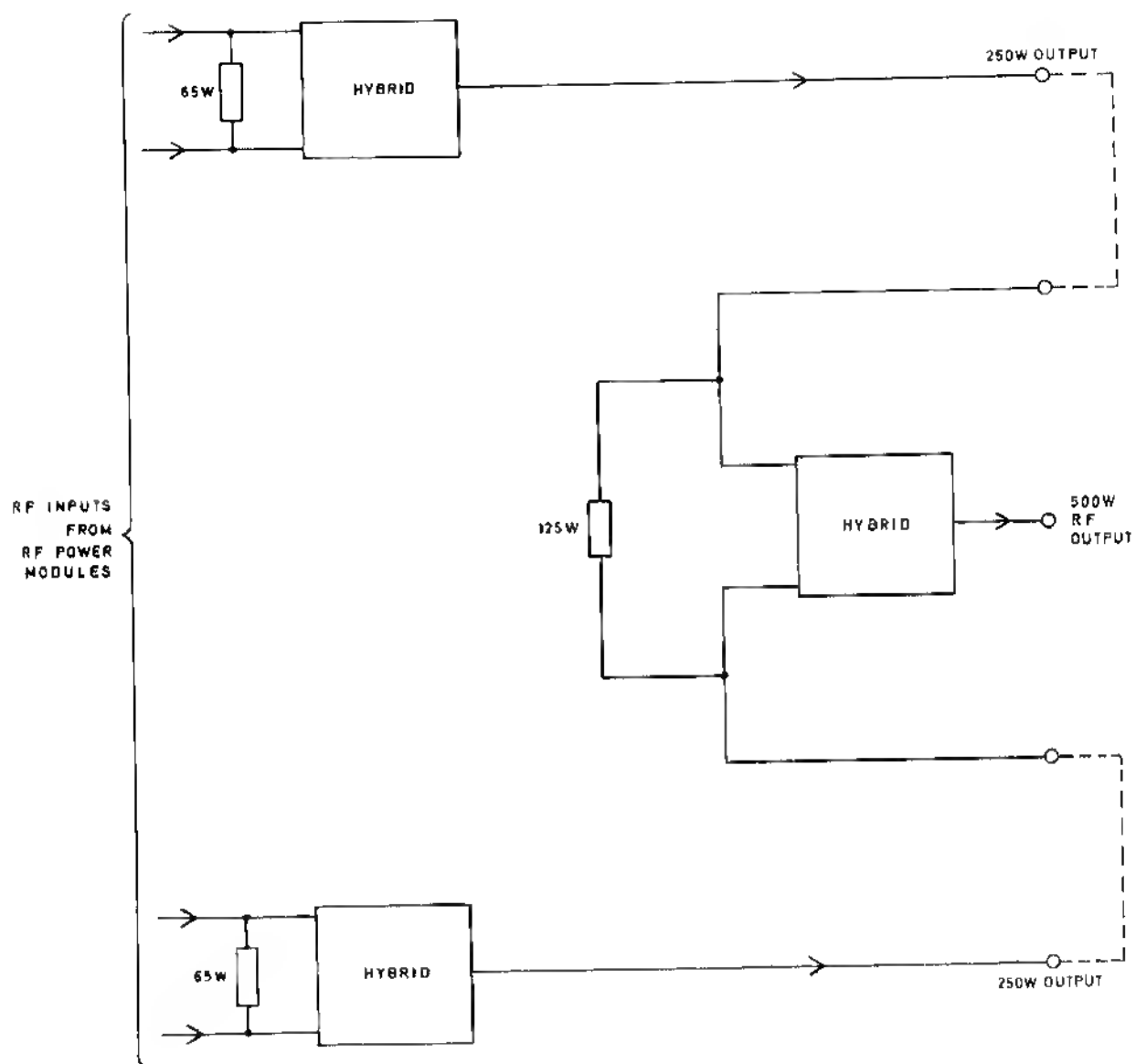
28. The main d.c. power supply for the TA. 1813 is provided by two d.c. power supplies Type MS64, each providing smoothed unregulated d.c. outputs to the individual stabilizers. The power supplies operate from a single phase a.c. mains input.

Stabilizer MS440

29. The stabilizer Type MS440 provides stabilized +30V d.c. and +20V d.c. supplies to each RF Amplifier Type MM320. In addition each stabilizer provides inputs to the +30V current metering facility on the Meter Panel.



Block Diagram: RF Amplifier MM320



CHAPTER 5

DETAILED TECHNICAL DESCRIPTION

INTRODUCTION

1. The circuit descriptions detailed in the following paragraphs should be read in conjunction with the appropriate circuit diagram.

CABINET ASSEMBLY

2. As outlined in Chapter 1, the TA.1813 cabinet assembly comprises the Muting Unit, Splitter Unit, Distribution Amplifier, Overload Unit, Cabinet VSWR Unit, Meter Panel and Control Panel. Fitted within the cabinet are blowers, coaxial line switching relays and interconnecting cableforms. The overall interconnection diagram is shown in Fig.32.

Control Panel MS377

3. Switching of the overall cabinet assembly can be accomplished from the local position (i.e. TA.1813 front panel) or from a remote position. Remote switching can be carried out in two ways:
 - (i) by the application of an external 12V supply to an internal relay, or
 - (ii) by the closure of a mains circuit by means of an external switch.

Selection of OFF, ON (local control) or REMOTE is made from the front of the cabinet assembly. The two power supplies and associated blowers can be switched off independently by operation of the appropriate circuit breaker.

Muting Unit MS564

Fig.34

4. The r.f. drive signal is fed to SK2 and routed, via an attenuator network, to the primary of transformer T2. Transistors TR1 and TR2 form a push-pull, class A amplifier operating in grounded base mode and providing approximately unity gain. The r.f. output from the secondary of T1 is fed to SK1. Base bias for TR1 and TR2 is derived from the emitter of TR3 and is approximately +9.3V, i.e. zener diode D3 voltage (+10V) minus TR3 base/emitter junction voltage (0.7V).
5. During normal operation (de-muted) the mute control line, PL1-3, is held at +12V; when muted it is grounded. Noise immunity is provided by diode D7. With the unit de-muted, the voltage at the junction D1/D2 is approximately +7.2V, i.e. zener D3 (+10V) minus the junction voltages of D5, TR5, TR7 and TR4 (0.7V each). As the emitter voltage of both TR1 and TR2 is approximately +8.6V, D1 and D2 are cut-off and TR1 and TR2 are conducting, thus allowing the r.f. drive signal at T2 to be coupled to T1.
6. When muting occurs, D8 is grounded and the base potential of TR6 falls to approximately +1.4V thus switching off TR6. This causes TR5 to be switched on allowing C8 to be charged-up via R14 and TR5. The base voltage of TR5 will now rise to approximately +12.1V (i.e. zener D3 (+10V) plus the junction voltages of D4, D9 and D6 (0.7V each)), and the voltage at the junction D1/D2 will rise to +10V, i.e. 12.1V minus the base/emitter junction voltages of TR5, TR7 and TR4. As D1 and D2 are now forward biased, they conduct thereby raising the voltage at the emitter of TR1 and TR2 to approximately +9.3V. Transistors TR1 and TR2 are therefore cut-off thus blocking the r.f. drive.

7. On de-muting, the mute control line at PL1-3 reverts to +12V switching on TR6 which, in turn, switches off TR5. Capacitor C8 will now discharge through R16 reducing the voltage at the emitter of TR5. (Transistors TR7 and TR4 form a Darlington pair which prevents significant loading across C8, thus ensuring the major discharge path for C8 is R16.) The fall in voltage at the base of TR5 will be held to approximately +9.3V by the action of D5. During the discharge time of C8 (approximately 5 to 7 milliseconds) the potential at D1/D2 junction falls to approximately +7.2V, i.e. +9.3V minus the base/emitter junctions of TR5, TR7 and TR4. As the potential at D1/D2 falls, TR1 and TR2 start to conduct, thus ensuring that the r.f. drive to SK1 is restored at a controlled rate.
8. The attenuation level afforded by the muting action is approximately 40dB at the H.F. end of the frequency range, and greater towards the L.F. end.

Splitter Unit MS444

Fig. 1

9. The RF input from the muting unit is fed in at SK1. It is then routed, via an attenuator network, to a passive splitter (R9 and R10) to provide two equal outputs at PL1 and PL2.
10. The output of the attenuator stage, at the junction of R9 and R10, is detected and a d.c. output fed from an emitter follower (TR1) to provide meter indication of the RF level. Calibration of this is effected by R12.
11. Four stabilizer outputs are connected via diodes in the appropriate Distribution Amplifier and the outputs from the two Distribution Amplifier supplies are connected via diodes in the Splitter Unit, this ensures that the Splitter Unit will always have a supply whilst one MS440 module is operating.

Distribution Amplifier MS240

Fig.3

12. The Distribution Amplifier provides a nominal 3dB gain from the two inputs to each of the four outputs. One input from the Splitter Unit is fed into SK5 which is connected to auto transformers T2 and T4. Capacitor C4 ensures that the input impedance is correct. The centre tap of each transformer is fed via a resistor to the emitter of grounded base transistors (TR1 and TR2) biased by a DC voltage derived from a resistive network R1 and R2 across the 30V supply rail.
13. The collectors of transistors TR1 and TR2 are transformer-coupled providing isolated RF outputs at SK1 and SK2. The diodes D1, D3 and zener diodes D2, D4 across each output transformer ensure that the positive collector voltage swing never exceeds the safe transistor rating.
14. The input at SK6 is fed to a circuit, comprising TR3 and TR4, which operates in a similar manner to that given in paras. 12 and 13.
15. Four 30V inputs at PL1, Pins 1, 2, 3 and 4, fed from the four MM440 stabilizers, ensure that the Distribution Amplifier can still operate as long as just one MM440 stabilizer remains active. The inputs are connected via diodes D9 to D12. The 30V output at PL1 Pin 5 connects to the Splitter Unit.

Overload Unit MS443

Fig. 5

16. The function of this unit is to provide a 'reduced power' warning signal in the event of failure of a power supply to an RF module. It also provides a 'fault' signal if either the main contactor fails or a fault signal is received from an associated unit, such as the MA.1004 Feeder Matching Unit.
17. The DC outputs of both MS64 units are monitored and fed to PL1, pins 8, 9, 11 and 12 of the Overload Unit. Each input is fed via noise immunity circuits (e.g. C1, D1, R3, R7). These circuits ensure that transient noise spikes will not cause the circuit to give a false indication, and that they will only respond to genuine input signals. The input transistors are connected in series so that when any are switched off due to having no input, TR5 will be switched on.
18. If an RF imbalance signal, whose value exceeds the bias on the base of TR8, is present at PL1 pin 4, TR6 will switch on, TR9 will switch off, TR7 will switch on, TR10 will switch off and C9 will charge via R25. Transistors TR11 and TR12 form a latching circuit which, in the normal state, has TR12 switched on and TR11 off. However, as C9 charges up, after an RF imbalance signal is received, TR11 is turned on, and after a delay, the circuit switches over to the latched state with TR11 conducting and TR12 switched off. In this condition TR13 is switched off and +12V (via R35) appears at the output PL1 pin 10 to operate an external circuit. In the normal operating condition the output at PL1 pin 10 is 0V.
19. This latched condition is maintained even if the fault signals are removed. It is set by an unlatching signal applied to PL1 Pin 1 from the external 'Coarse-tune initiate/Reset' or the 'Ready/Not Ready' line. This is normally derived from the MA.1720 drive unit. Noise immunity is provided by D8, D9, R36 and C11.

Cabinet VSWR Unit MS447

Fig.7

20. This unit monitors the forward and reflected powers on the RF output feeder and provides the respective d.c. outputs to the Meter Panel MS445. The design is that of a conventional reflectometer and is identical in principle to the RF Module VSWR unit described in paras. 41 to 48. It is balanced by adjusting C3 for an indicated null on reflected power when the feeder is terminated in 50 ohm.

Meter Panel MS445

Fig.9

21. This unit contains two meters; ME1, which is switched and meters the +30V, +20V supplies to, and the +30V supply drawn by, each of the four RF modules, and ME2, which is switched to monitor the input power (fed from the Splitter Unit), and the forward and reflected powers fed from the VSWR Unit. Only positions 1 to 4 of switch SA are used.

22. Also included is a VSWR Warning P.C.B. (Fig.11) which contains a trip circuit operating from the VSWR Unit reflected power line. The trip circuit comprises a long-tailed pair, TR2 and TR3, driven from TR1. TR4 provides the output which can be used to operate a 'fault' line to a suitable external circuit. The trip level is normally set to operate at 3:1 VSWR but can be changed by altering R12.

23. Switch S1 on the VSWR Warning Board is set to NORMAL during traffic condition. The CAL position is used during setting-up procedure.

RF AMPLIFIER MM320

Interconnection of Sub-Units

Fig.21

24. The overall interconnections of the sub-units making up the RF Amplifier Assembly are shown on Fig.21.

Inputs

25. The power supply inputs are +20V and +30V DC on TS1 pins 3 and 2 respectively. These are connected directly to the associated Stabiliser Unit Type MM440. The only other connection is the external muting line on TS1 pin 4. This applies a 0V signal to the Low Level Board which operates the relevant switching transistors thereby cutting off the RF output. The RF input from the Distribution Amplifier is at PL1.

Outputs

26. The RF Output appears at PL2. It is fed from two outputs on the High Level Board, which are connected together prior to T1. The latter is a monitoring transformer, feeding LP2 and an external RF monitoring socket. T2 is the reflectometer toroid for the VSWR unit and C3 is the associated capacitive probe.

Protection Components

27. CSR1 is fired under a fault condition from the Protection Board, thereby short-circuiting the +30V line and blowing FS1 if the stabilizer trip does not operate. C1, L1 and C2 are RF decoupling components. THE1 is the thermostat on the Assembly heat sink which open circuits the +20V supply rail if the safe working temperature (approx. 85°C) is exceeded.

Low Level Board PS351

Fig.13

28. The RF input is connected to pins 4 and 5 of the printed circuit board. It is transformer coupled via T4 to provide a balanced push-pull signal at the a.i.c. stage

which consists of TR18, TR19, D15, D16 and associated components. Transistors TR18 and TR19 act as an RF amplifying stage operating in class A grounded-base mode. Diodes D15 and D16 provide control of the stage by shunting a part of the drive current, thus reducing the output of the TR18, TR19 stage, in accordance with an input signal from TR7 (see para.33).

NOTE: Two versions of the board are available, version DC604137/A which has a normal a.l.c. discharge time and version DC604137/B which has a long discharge time. The differences between the two versions are given on Fig.13.

29. The RF output from the a.l.c. stage is transformer coupled (via T3) to the following amplifier stage comprising TR17 and TR21 which also operates in a grounded base, push-pull class A condition.
30. T2 couples the signal to the emitters of the final stage of the Low Level Board comprising TR15 and TR16 in parallel, operating push-pull class A, with TR20 and TR22 in parallel.
31. T1 combines the outputs from TR15, TR16 and TR20, TR22 and feeds the signal at between 1W to 2W to pins 2 and 3 of the board.

Automatic Level Control (a.l.c.) Detectors (On Low Level Board)

32. The forward d.c. voltage derived from the VSWR Board is fed to pin 11. R1 is the 'set forward power' control which determines the threshold level at which the a.l.c. holds the output power under normal conditions. This voltage is amplified by TR1 and is gated via D1 into the a.l.c. switching circuits.
33. The d.c. voltage derived from the reflected power monitor on the VSWR Board is amplified by TR3 and is combined with a fixed fraction of the forward power (via TR2) at the parallel collectors. The output signal, whose level is adjusted by R6, controls the level at which the a.l.c. will respond to a reflected power signal caused by a load mismatch. This output is gated to the a.l.c. switching circuits via D2. These circuits provide current gain via TR6, TR7 and TR24 (where fitted) and a reference level determined by R29, D20 in conjunction with TR9, TR11 and TR25 (where fitted) and associated components.
34. The attack time is approximately 200-500 μ s and the discharge time is determined by C3 discharging through R18. When TR24 and TR25 are fitted and R18 = 1Mohm this approximates to 1 second. Normally, however, the discharge time without TR24 or TR25 and R18 = 100K is approximately 50 milliseconds.

Muting Circuit (On Low Level Board)

35. The external muting signal is applied to pin 12 (0V muted, +12V normal). With +12V applied, TR10 and TR12 are switched on, thereby supplying +20V to the TR17/TR18 amplifier stage. TR13 is also conducting, supplying a positive bias voltage to the final amplifying stage. Under muted conditions transistors TR8, TR10, TR12 and TR13 are cut off thereby applying muting to both the penultimate and final stages.
36. On the standard version (DC604137/A) of the amplifier, when muting occurs the gain of the a.l.c. stage is increased to maximum by the action of D13 and R52 which reduce the voltage on C3. On the DC604137/B version this effect of increased gain of the a.l.c. stage is reduced by D14 and R54 which reduce the voltage on C12. However, since the action of D13 and R52 is still present the module will operate at maximum gain, after a short delay, on de-muting.
37. TR8 and associated diodes, resistors etc., form an input noise immunity circuit. Diodes D11 and D12 provide temperature compensation for TR13 to maintain a stable bias voltage.

High Level Board PS315

Fig. 15

38. The RF input signal from the Low Level Board is connected to pin 4 which feeds four transformers whose primary windings are connected in parallel via T6, T7, T9 and T10. The secondary winding of T6 and T7 each feed a group of three paralleled resistors and all 6 feed the emitter of TR5. T9 and T10 are similarly connected to drive the emitter of TR6 but are wired in antiphase to T6 and T7. The resultant effect is therefore to drive TR5 and TR6 in push-pull. TR5 and TR6 form the driver stage and operate in grounded base Class B mode. T8 is the driver output push-pull transformer, and it drives T11/T12 and T14/T15 in push-pull, and also T11/T12 and T14/T15 in push-pull. Transformers T4, T5, T11 and T12 are therefore all connected in parallel. Similarly T1, T2, T14 and T15 are also connected in parallel, both groups operating in push-pull.
39. All eight transformers are 2:1 step-down auto-transformers driving the base of each of the eight P.A. transistors. The eight transistors are connected as four parallel pairs, operating in push-pull, each stage being a grounded emitter class B amplifier. TR1 and TR2 are in parallel giving an output via T3 in push-pull with TR3 and TR4 which are in parallel. Similarly TR7 and TR8 are in parallel giving an output via T13 in push-pull with TR9 and TR10 which are also connected in parallel. The outputs of T3 and T13 are connected together (external to the board) to provide the output of the module.
40. RF feedback is applied from the collectors of each pair of output transistors via a 470 ohm resistor to the collectors of the appropriate driver transistors.

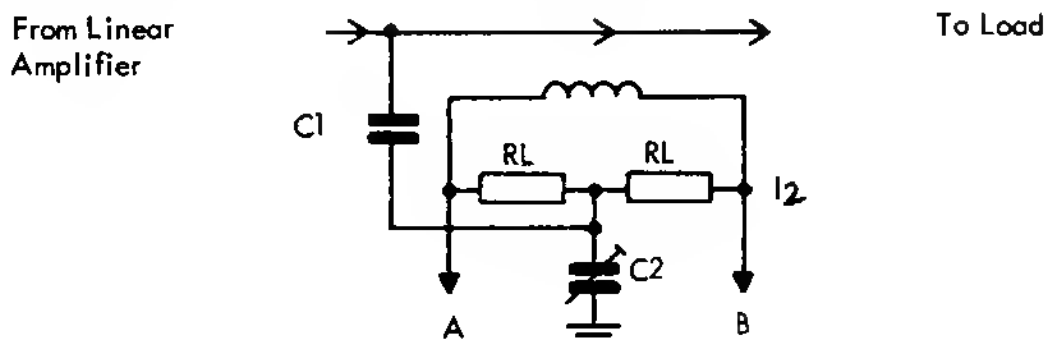
V.S.W.R. Board PS316

Fig. 17

41. Two RF inputs are fed into the VSWR Board. The first is derived from the reflectometer toroid T2 and is proportional to the RF output line current, and the second is fed from C3 (Fig.21) which is proportional to the RF output line voltage.

Principles of Operation

42. A simplified circuit of the VSWR Board is shown below to illustrate the principle of operation.



43. The secondary induced voltage in the feeder toroid causes a current to flow I_2 which is equal to $\frac{j\Omega M I_1}{2RL + j\Omega L_2}$ where I_1 is the primary current, M is the toroid mutual inductance, $2RL$ is the total secondary load resistance and L_2 is secondary inductance of the toroid, Ω is the angular frequency in radians.
44. If $2RL \ll j\Omega L_2$ at the lowest frequency then $L_2 = \frac{MI_1}{L_2}$ which is independent of frequency. The output voltage developed across each secondary resistor is then $I_2 RL$ and they are 180° out of phase.
45. The RF voltage divided down by C_1 and C_2 is applied between the resistor junction point and earth, and adjusted by C_2 so that, with the matched line condition, the voltage across C_2 is equal in amplitude to the voltage across each resistor. This voltage V_c is also not frequency conscious since $V_c = \frac{V_1 C_1}{C_1 + C_2}$ and is in phase with the voltage across one RL and out of phase with the other. The result is that under matched conditions at terminal A the voltage ($V_c + I_2 RL$) appears (the forward power output) and at terminal B the voltage ($V_c - I_2 RL$) = 0 appears (reflected power output).
46. Under mismatched conditions such that a short circuit appears on the feeder, then V_c is zero and the forward and reflected outputs are equal. Similarly with an open circuit on the line, the voltages appearing across the two resistors from the toroid are zero, and again the forward and reflected outputs are equal.
47. It can be shown that intermediate mismatched impedance produces some output from the reflected port, but that the forward output remains constant for a given linear amplifier output power.
48. R_1 and R_2 form the resistor loads and C_3 and C_5 , in parallel, produce the required capacitive voltage. The outputs are coupled via C_2 and C_7 , then rectified by voltage doubler circuits (D_1 , D_2 , C_1 and D_5 , D_6 , C_8). C_9 and R_5 boost the low frequency

power response of the module, by effectively reducing the d.c. level at the forward output at the low frequency end (i.e. below approximately 5MHz). This means that more power is required from the RF amplifier module to reach the same a.l.c. threshold voltage.

Protection Board P5251

Fig.19

49. The Protection Board has two main functions.

- (1) It monitors the module positive supply voltage and if this exceeds a safe operating level, a pulse is generated to fire a thyristor (mounted on the RF power module chassis) which in turn trips the stabiliser or if this has failed blows an associated fuse FS1.
- (2) It also monitors the DC current taken by each group of four output transistors and operates the a.l.c. line if this exceeds a predetermined level.

50. The +30V supply is monitored on pin 1 and connected via a chain of Zener diodes, and a potentiometer R1 to the base of TR1. R1 provides an adjustable reference voltage for the operation of the long-tailed pair comprising TR1 and TR2. The output from TR1 is amplified by TR3, the operating voltage of which is determined by R10 and R13. When transistor TR3 conducts, a voltage is generated which operates the thyristor gate, SCR1, via pin 8.

51. The d.c. current overload inputs are fed to pins 3 and 4; as either or both these levels increase, transistors TR4 and TR5 will start to conduct and cause TR6 and TR1, connected as emitter followers, to conduct and provide a d.c. output to the a.l.c. circuit via pin 5 of the p.c.b. Diode D7 maintains C3 in a charged state so that TR6 will switch on quickly. The Zener diode D5 limits the maximum voltage to approximately 12.5 volts to prevent possible damage to the transistors in the a.l.c. stage on the Low Level Board.

COMBINING UNIT MS126

Fig.23

52. The Combining Unit is a completely passive unit which combines the 125W outputs from the RF Power Modules to produce the 500W output.

Power Combining

53. The operation of the Combining Unit is best described by considering just one combining operation. Thereafter all subsequent combining sequences are essentially the same, apart from variations of actual impedance and power level. The principle however, applies at each stage.

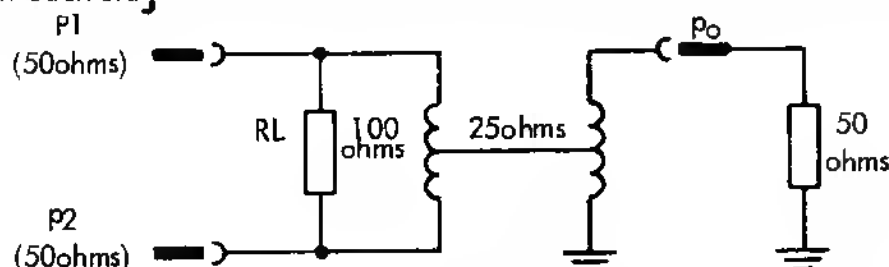


Fig. (a)

54. Fig.(a) shows a simple combining circuit with a 50 ohm input and 50 ohm output impedance. The features of this network are as follows:-

If P_1 and P_2 are equal and in phase then $P_o = P_1 + P_2$ and there is zero power dissipated in R_L .

If $P_1 = 0$ then $P_o = \frac{P_2}{2}$

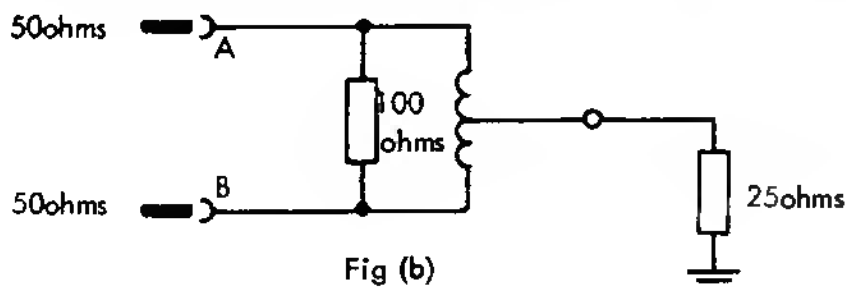
i.e. -6dB reduction on original P_o with both inputs present. In this case $\frac{P_2}{2}$ is also dissipated in R_L . If P_1 and P_2 are 180° out of phase, zero power appears at the output and $P_1 + P_2$ is dissipated in R_L .

55. Although for maximum power output P_1 and P_2 should ideally be matched exactly in amplitude and phase, fairly large differences can be tolerated within the extremes quoted above before a significant reduction in output power occurs. For example, a 10% difference in amplitude results in a power output reduction of approximately 0.2% while a phase difference of 10° only results in a power output reduction of 0.75% of the total input Power $P_1 + P_2$.

Isolation

56. The second basic property of the combining network is that it provides isolation between the two inputs. This means that any impedance change at either input does not affect the input impedance presented to the other generator.
57. How this isolation is achieved is illustrated by considering the equivalent circuit of the two extremes i.e. open circuit and short circuit as well as the normal 50 ohm condition.

58. Fig. (b) shows the 50 ohm input case. Since there is no voltage, i.e. output and input volts are the same and no power dissipation i.e. power output equals the power at A + the power at B, the output impedance must equal half the impedance at A or B. Therefore the impedance at the hybrid transformer output is 25 ohm for the two inputs to be 50 ohm.



59. Fig. (c) shows the equivalent circuit for a short circuit at input B. The 50 ohm impedance at the hybrid output is transformed up to 100 ohm at input A, in parallel with R_L giving a resultant input impedance of 50 ohm (i.e. as normal).

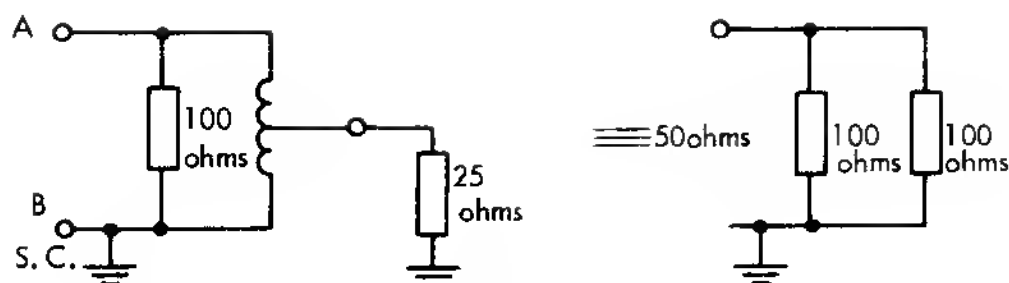


Fig.(c)

60. Fig. (d) shows the equivalent circuit for an open circuit at input B. The 100 ohm impedance of RL is transformed to 25 ohm in series with the existing 25 ohm load impedance giving a resultant impedance of 50 ohm at input A (i.e. as normal). It can be shown that input A will always be 50 ohm for miscellaneous impedances appearing at input B.

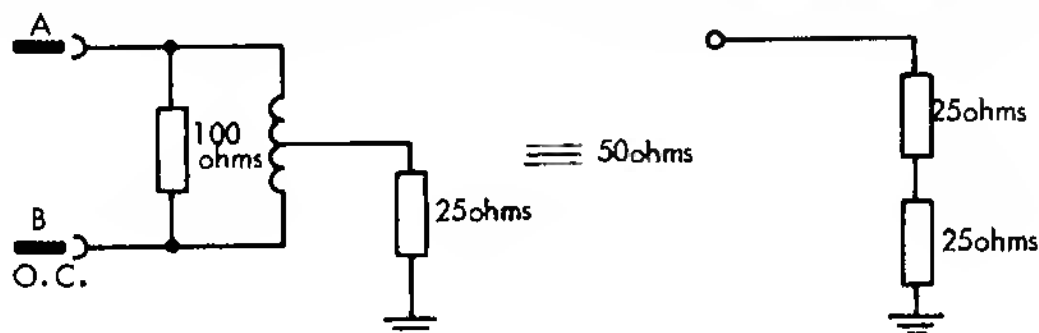


Fig. (d)

Design Features

61. In order to meet the theoretical performance outlined in the preceding paragraphs it is necessary to provide balancing coils in series with each ballast resistor to ensure optimum isolation and input impedance matching over the full frequency range. This offsets the effects of transformer leakage inductance and circuit stray capacitance which would otherwise cause an inferior performance.

WARNING

THE SETTING OF THESE ADJUSTABLE INDUCTORS (BALANCING COILS) IS CRITICAL AND THEY ARE ACCURATELY SET UP BEFORE DESPATCH FROM THE FACTORY. ANY FURTHER ADJUSTMENT SHOULD NOT BE NECESSARY BUT IF ADJUSTMENT IS NECESSARY THE PROCEDURE GIVEN IN CHAPTER 7 PARA. 14 MUST BE FOLLOWED.

Power Dissipation

62. As described previously, if power from one or more modules is lost then an unbalanced situation is created in the combining unit which results in power dissipation within the combining unit, as well as a reduction of output power. Fig. 5.1 shows the approximate output power against numbers of inoperative modules - the white sections show the power dissipated internally and the shaded columns indicate the actual output power.

NOTE: The conditions given in Fig. 5.1 are 'worst case'. With two modules operational the linear amplifier can be 'patched' to give 250W output (refer to Chap.2, para.7).

63. The combining unit is rated to withstand the maximum dissipated power (i.e. 125W) continuously. A warning signal is however signalled showing that power is being lost in the combining unit. This is sensed by a current transformer in each input ballast resistor line. This RF unbalanced signal is rectified and fed to the Overload Unit MS443 where it is available to operate an external circuit which will indicate that the TA.1813 is operating on reduced power. It is only a warning indication and does not trip the amplifier, as there is no risk of damage whilst continuing to operate in this condition.
64. The four RF inputs from the RF modules are fed into hybrid transformers in pairs. Inputs 1 and 2 are fed to opposite ends of T3 and T5 in parallel. Inputs 3 and 4 are connected to opposite ends of T4 and T6 in parallel.
65. Also connected in parallel with T3 and T5 is ballast resistor R3 in series with a current monitoring transformer T1 and an inductor L1. L1 operates in conjunction with C3 and is adjusted for maximum isolation and optimum input impedance matching. The output of T1 is detected by R1 and D1 and fed to PL1 pins 5 and 6, then to the Overload Unit, to provide an RF unbalance signal. The remaining input circuit is similar to that described.
66. The outputs from T3, T5 and T4, T6 are fed to a further hybrid transformer stage T11 via T7 and T8 which provides a 50 ohm output. R5 and R6 are connected in parallel across the primary of T11, forming the ballast load in series with L3, which improves isolation. Two 250W outputs can, if required, be taken from SK5 and SK6.
67. The output from T11 is at an impedance of 25 ohm and is 'stepped up' to 50 ohm by T12. This is then fed to SK7 via T13 current monitoring transformer. C5 is included to improve the isolation of the two 250W inputs. T13 is a current transformer for output monitoring.

AUTOMATIC LEVEL CONTROL AND PROTECTION

68. The overall Automatic Level Control (a.l.c.) protection aspect of the TA.1813 Linear Amplifier is an important and basic feature of the design, both for normal operation and for protection under abnormal conditions.
69. Protection of the transistorized RF Power Modules is vital for the overall reliability of the equipment and in many instances the protection circuits operate via the a.l.c. stages of the module so that the two are closely interdependent.
70. The details of the actual a.l.c. stage have been described in paras. 32 to 34. It is this stage which is controlled under various overload conditions as well as for normal operation.
71. The following inputs are connected to the a.l.c. and, on exceeding the pre-set threshold level, will determine the operating gain and hence the output level of the RF Power Module.

- | | | | |
|-----|---|---|---|
| (1) | Forward Power | - | normal operation into 50 ohm. |
| (2) | Reflected Power | - | operates the a.l.c. if mismatch at the outputs of the module is worse than approximately 2:1 VSWR. |
| (3) | Transistor Collector RF Voltage (Swingometer) | - | Operates the a.l.c. if the voltages exceeds a pre-determined level (normally approximately 25V peak). |
| (4) | DC current | - | Operates the a.l.c. if the mean d.c. current, when driven, exceeds 15 Amps approximately. |

72. The levels at which the forward and reflected power take over control of the a.l.c. are adjustable but should only be set up in accordance with the instructions laid down in Chapter 7. In the case of the collector RF voltage and DC current detectors these are pre-determined by the design values of components and cannot be varied. The attack and decay times of the respective inputs are listed in para. 34 with the exception of d.c. current which is approximately 10 μ seconds.

73. In addition to the previously mentioned a.l.c. protection circuits, additional protection is included as follows:-

- (1) A thermostat to detect overheating of each module.
- (2) A 'latching' current trip circuit for each Stabiliser Unit.
- (3) A high rupturing capacity fuse for each module for protection against a stabilizer short circuit.
- (4) A magnetic circuit-breaker for AC supply input overload protection to each power unit.
- (5) Two fuses for low mains current consumption.

74. Together these overload circuits provide an extremely high degree of overall protection.

POWER SUPPLIES

Power Supplies Unit Type MS64

Fig.25

75. Each Power Supply Unit Type MS64 is a self-contained d.c. power supply providing smoothed unregulated d.c. outputs from a single phase a.c. supply.

76. Two outputs are provided:-

- (1) +36V at 30 amps
- (2) +42V at 100 milliamps.

Each incorporates a bridge rectifier, from two separate transformer windings. The +36V rail has a choke input filter, while the +42V supply employs a capacitor input filter. Under no load conditions, however, the +36V supply behaves like a capacitor input filter and the no load voltage rises to approximately 60V. The associated units are adequately rated to withstand this.

77. A plug-in mains selector is provided on each MS64, to provide simple adjustment on installation.

Stabilizer Unit Type MS440

Fig.27

78. The stabilizer Unit Type MS440 provides a stabilized +30V and +20V supply to the RF Amplifier Type MM320. It is fed from the main power supply unit Type MS64 which provides a smoothed nominal 36V, at full load, to each stabilizer.

79. In addition the Stabilizer unit provides current metering facilities for the +30V supply to each RF Amplifier Assembly. A fast acting current overload trip circuit is also included. The latter is reset by removing the d.c. input. All power dissipating components e.g. power transistors and resistors are mounted directly on the finned casting. The low level circuitry is included on a printed circuit board, PS313.

Output Ratings

80. The maximum current ratings of the two supply lines are:-

- (1) +30V at 15 amps
- (2) +20V at 2 amps.

81. The normal 36V DC input to the Stabilizer Unit from the MS64 power unit is connected to pins 12, 13, 14, 15 and 16 in parallel (positive) and pins 4, 5, 6, 7 and 8 in parallel (0V); pin 3 is a separate earth.

82. A second d.c. input at 42V is required to feed 4TR2 and 4TR5. This is also fed from the MS64 power units. The maximum current consumption, from the 42V supply, is 50mA. The +30V and +20V stabilised outputs appear on TS1 pins 2 and 3 respectively.

83. The stabiliser itself comprises three separate circuits as follows:-

- (1) +30V Stabilizer
- (2) +20V Stabilizer and
- (3) DC Overload/Trip Circuit.

+30V Stabilizer

84. The main d.c. input is fed to TR1 and TR4 connected in parallel. These are the main series stabilizing transistors. They are controlled by a feedback system comprising 4TR5, 4TR2 and 4TR3. Transistor 4TR5 is the comparator stage while 4TR2 and 4TR3 provide current amplification for the feedback loop. The emitter of 4TR5 is held at 5.6V by 4AD3 while the base voltage is derived from the stabilised +30V rail via an adjustable resistor 4A R10. This control determines the setting of the +30V output level.

85. The overall stabilizer loop functions as follows. As the volts tend to rise, due to a reduction of load current, TR5 base voltage will also rise, causing 4TR5 to conduct more, which in turn causes 4TR2, 4TR3 and TR1 and 4TR4 to conduct less. This gives a greater voltage drop across 4TR1 and 4TR4, thereby reducing the output voltage and opposing the initial change of output level. The circuit is therefore self compensating, and with the high loop gain involved relatively large input voltage variations have no effect on the output voltage.

+20V Stabilizer

86. This follows the +30V stabilizer and has 4TR7 as the main series stabilizer, with 4TR6 as an amplifier and 4TR4 as the reference detector stage. The output level is set by R16. In principle it functions exactly as the +30V stabilizer.

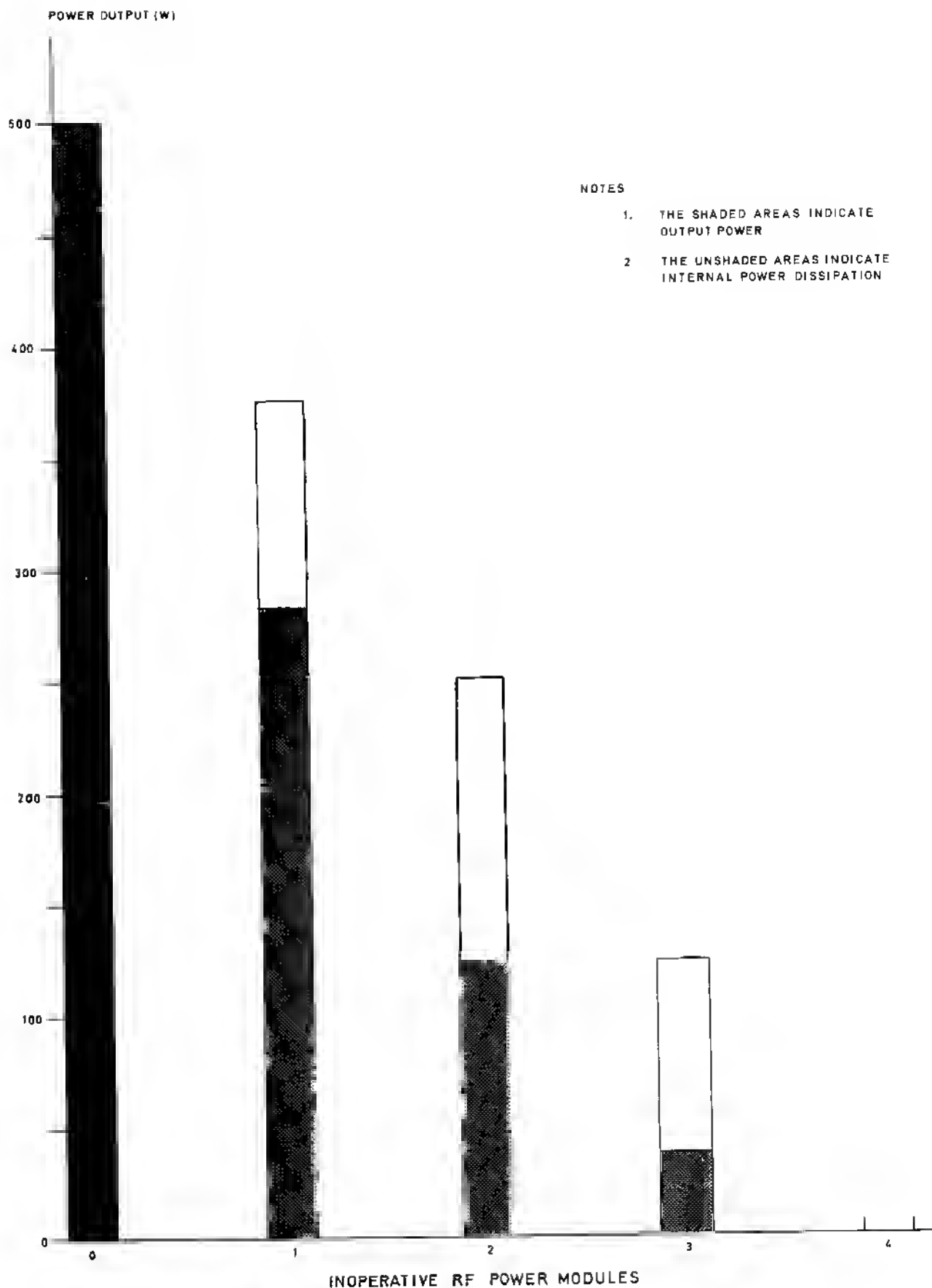
D.C. Trip Circuit

87. As the d.c. load current increases the voltage drop across 4R1 increases. This increases the voltage appearing across the base of 4ATR1 - which is adjustable via 4AR3. Under normal conditions this voltage is insufficient to cause 4ATR1 to conduct so that 4ATR2 is also non-conducting. The collector voltage of 4ATR2 is high and therefore isolated from the main +30V stabilizing feedback loop, i.e. base of 4TR2, by 4AD2.

88. A similar trip circuit for the +20V supply is provided by 4ATR3, the trip voltage being developed across R9 and applied to board pins 9 and 10. Transistor 4ATR3 is coupled to 4ATR1 via diode 4AD1.

89. The voltage level at which 4ATR3 starts to conduct is determined by the V_{be} of 4ATR3 i.e. 0.6V. Under normal operating conditions this voltage is less than 0.6V and again 4ATR2 is non-conducting.

90. In the event of either 4ATR1 or 4ATR3 switching on however, caused by an overload current in either the main input or the +20V stabilizer input, then 4ATR2 will switch on, causing the main +30V stabilizer transistors to be switched off. Positive feedback between 4ATR2 and 4ATR1 then causes them to 'latch' on, so that the main stabilizing transistors are held non-conducting until the unit is reset by interrupting the d.c. supply in, by unplugging and re-inserting the RF Power Module or by operation of the appropriate circuit breaker on the front panel of the Power Supply Unit.



Ratio: Approximate Output /
Inoperative Modules

CHAPTER 6

ROUTINE MAINTENANCE, DISMANTLING AND REASSEMBLY

ROUTINE MAINTENANCE

1. Routine maintenance requirements on the TA.1813 amplifier are minimal, as only the following items need be checked at regular intervals.

Centrifugal Type Blowers

2. The two air blowers fitted above the power units embody bearings which are 'sealed for life'. No regular maintenance action is, therefore, required.

'Woods' Type Air Blower

3. A Woods type air blower is fitted at the top rear of the cabinet. After a considerable period of use, or after some 12 months storage under tropical conditions without use, it may be found that the oil has migrated from the grease in the bearings of this blower. As a result the blower will start to overheat, and will ultimately seize up and fail.
4. To obviate this failure the blower should be overhauled and the bearings replaced at routine intervals. This could be immediately before putting into service if storage as above has occurred, or after 1 to 5 years operation dependent upon environment and duty cycle.
5. A spare set of bearings, packed for tropical storage, can be obtained from Racal (Part No. BA44126). The bearings are Ransome Hoffman Pollard type 106P V2 and the grease is SHELL ALVANIA RA. Bearing replacement should be carried out as follows:
 - (1) Disconnect the mains supply to the unit and render the unit safe.
 - (2) Disconnect the mains leads to the blower and remove the blower from the unit.
 - (3) Using a 4 B.A. open-jaw spanner, slacken off the hexagon headed screw retaining the impeller. Remove the impeller and clean off any dust. Remove any dust from the fan housing.
 - (4) Using a 6 B.A. box spanner, remove the two nuts securing the two through-bolts. Withdraw the through-bolts.
 - (5) Remove the rear bearing housing.
 - (6) Remove the rotor with its two bearings. If the rotor and bearings show signs of gross over-heating (due to a stalled blower left on for a considerable time) the blower should be scrapped. A certain amount of discolouring will not, however, be harmful.
 - (7) Remove the bearings using a bearing puller, taking care to avoid damaging the shaft. Scrap the bearings.

- (8) If the shaft is scored or damaged, restore polish with very fine emery. The new bearings should be a neat fit, not requiring excess force to fit them, but the shaft must not slip in the inner race.
- (9) Fit the replacement bearings, non-shielded faces outwards avoiding pressure on the outer race. If SHELL ALVANIA RA grease is available it may be added to the two bearing housing after cleaning. This will increase the life of the blower by acting as a reservoir. Excess grease will cause pressure in the bearing, which will result in over-heating and failure.
- (10) Check the field windings for overheating, continuity and insulation to frame. Clean off any dust.
- (11) Refit the rotor with bearings and bearing housings. Secure with two through-bolts.
- (12) Re-fit the impeller, ensuring that the screw seats in the dimple in the shaft.
- (13) Before re-fitting the blower, connect to the mains supply and check for correct operation.
- (14) Return the blower to the unit and reconnect all leads.

Air Filter

6. This should be washed at appropriate intervals in water with a detergent.

NOTE: Ensure filter is completely dried before replacing in cabinet.

Contactor Contacts

7. It is recommended that the contacts on the main switching contactor be examined every six months, and replaced if significant deterioration is observed.

DISMANTLING AND REASSEMBLY

8. Modular construction is used throughout and access to all sub-units and cabinet connectors is via the front of the cabinet.

Power Supply Unit MS64

9. The Power Supply Units Type MS64 are mounted in the base of the TA.1813 cabinet.

CAUTION: When the cabinet is not fixed to the floor care should be taken in withdrawing power units to avoid the danger of the cabinet toppling.

Removal

10. (1) Switch off the circuit breaker appropriate to the power supply unit to be removed.
- (2) Undo the quick-release screws holding the Power Supply Unit front panel and remove the panel.

- (3) If power is not fully isolated, use a meter to re-check that mains is not present on the unit to be removed.
- (4) Remove the cable clip from the front of the power unit, and remove six cables (see Chap.3, para.10).
- (5) Remove two screws and slide out the power unit and its mounting tray.
- (6) Repeat for other power unit if required.

Replacement

11. Replacement of a power supply is effected by reversing the procedure described in para.6(1) to 6(6), but reference should be made to Chap.3, para.10.

Splitter Unit, Distribution Amplifier, Overload Unit and Muting Unit

12. The Splitter Unit, Distribution Amplifier, Overload Unit and Muting Unit are mounted on a pair of hinged angle members which are located above the power supplies. The cover to each unit is secured by four slotted screws whilst the units are secured to the hinged angles by Pazidriv screws. The angle members and units can be swung out on hinges for access to blowers by removing two screws from the left hand side of the angles.
13. To gain access to the Muting Unit, which is mounted behind the Splitter Unit, proceed as follows:-
 - (1) Isolate the cabinet from the mains supply.
 - (2) Remove the power supplies panel and control panel.
 - (3) Hinge forward the angle members as described in para.12.

Circuit Breakers

14. The circuit breaker assemblies and contactor are mounted on the control panel, which can be unplugged after four screws have been removed.

Air Blowers

15. Two air blowers are located immediately above the power supplies. The control panel should be removed to give access to the fixings on the blower plate.

Removal

16.
 - (1) Isolate the cabinet from the mains supply.
 - (2) Remove the power supplies panel and control panel.
 - (3) Hinge forward the angle members as described in para.12.
 - (4) Slide the power supply units forward to their fullest extent.
 - (5) Disconnect the cables at the blower terminals.
 - (6) Use a 3/8" box spanner through the access holes, provided by removing the control panel, to undo the 4 blower plate captive fixings.
 - (7) Lower the blower and remove it from the cabinet.

Replacement

17. (1) Replacement of an air blower is effected by reversing the procedures described in para. 16.
- (2) Before attempting to tighten the 4 blower plate captive fixings, locate the blower in position and ensure that fan outlet is correctly located within the air duct.

Meter Panel

18. The Meter Panel is located above the RF Power Modules and houses two meters and the VSWR Warning PCB.

Removal

19. (1) Remove cabinet connector mating with the Meter Panel Plug (11PL1).
- (2) Remove the 4 screws securing the hinges and remove the Meter Panel from the cabinet.
- (3) To obtain access to the meters and the VSWR Warning PCB remove the 5 fixing screws (3 front and 2 rear) and remove the cover.

NOTE: Access to the VSWR Warning PCB may be gained without removing the meter panel.

Replacement

20. To replace the Meter Panel reverse the procedures detailed in para. 19.

Combining Unit

21. The unit or units located above the Combining Unit must be removed to give reasonable access to the rear fixings.

Removal

22. (1) Remove the MA.1004 FMU (see appropriate handbook).
- (2) Remove top cover from combining unit.
- (3) Disconnect the four RF connectors and the multi-way connector from the rear of the unit.
- (4) Disconnect the RF connector from the front of the unit.
- (5) Remove the two fixing screws from the rear edge of the unit.
- (6) Loosen the two quick-release fasteners at each side of the unit.
- (7) Lift one side of the unit and ease it out from the cabinet through the gap immediately above, taking care not to foul cables.

Replacement

23. Replacement of the Combining Unit is effected by reversing the procedures detailed in paras. 22(1) to 22(7).

RF Power Modules

24. The RF Power Modules are removed by undoing the 2 quick release screws and sliding the module forward from the cabinet. When replacing a module ensure that it is properly located in the guide channel.

RF Power Module MM420

25. To separate the Stabilizer Module from the RF Power Module proceed as follows:
- (1) Slacken the 4 fixing screws on tag strip TS1 and remove the fanning strip.
 - (2) Remove the fixing nuts and washers on both RF connectors (5PL1 and 5PL2) on the rear panel noting carefully the order in which the washers are removed.
 - (3) Remove both Pozidriv screws connecting the top plate of the MM440 Module to MM320 Module.
 - (4) Slacken off the two nuts and bolts connecting the mating edges of the heat sink.
 - (5) Remove the Stabilizer Module by pulling it in the direction of the heat sink.

High Level Board and Protection Board

26. To obtain access to the High Level Board proceed as follows:
- (1) Place the complete module assembly on a bench with the front panel of the module to the right and the heat sink on the bench.
 - (2) Remove the fixing nut on plug 5PL2 on the rear panel noting carefully the order in which the washers are removed.
 - (3) Remove both Pozidriv screws fixing the Low Level plate to the pillar nuts.
 - (4) Remove 2 nuts and bolts connecting the Low Level plate to the front panel.
 - (5) The Low Level plate may now be hinged away to give access to the High Level Board.

CAUTION: If it is required to operate the module in this condition care must be taken to ensure that the Low Level plate does not short the live points.

WARNING:

THE P.A. TRANSISTORS AND THEIR ASSOCIATED INSULATING WASHERS CONTAIN BERYLLIUM OXIDE, THE DUST OF WHICH IS TOXIC. BEFORE HANDLING THESE DEVICES REFER TO THE SAFETY PRECAUTIONS AT THE FRONT OF THE HANDBOOK.

Method of Changing a P.A. Transistor

27. (1) Remove the fixings on the Low Level Board sub-assembly (including its mounting plate) so that it can be hinged up and over to gain access to the High Level Board (refer to para. 26). Unsolder the pins of the relevant

transistor, and then place the module in its normal upright position with access to both sides of the transistor.

- (2) Undo the nuts on the stud end with a box spanner. To do this and prevent rotation of the transistor it will be necessary to hold a brood screw driver blade against one side of the hexagonal shaped transistor body through the appropriate hole on the High Level Board.
- (3) When refitting a new transistor use new insulating washers (Rocol Part No. 920916) if necessary and cover both sides of the washer with 'Thermostat' thermal paste Type A30/J (Jermyn Industries) before assembly. Reverse the procedure detailed in (1) and (2) for reassembly.

NOTE: It is important 'Thermostat' or other high conductivity paste is used in preference to silicone grease to ensure adequate thermal conductivity.

Access to Stabilizer Heat Sink

28. Remove the Stabilizer (refer to para. 25) or hinge back the Low Level plate (refer to para. 26).
Undo 2 screws fixing the top plate to the rear plate on the stabilizer. Hinge back the top plate to obtain access to the components mounted on the stabilizer heat sink.

CHAPTER 7

FAULT LOCATION & ALIGNMENT PROCEDURE

INTRODUCTION

1. A list of test equipment required for fault location and alignment procedure is given below.

TEST EQUIPMENT

2.

(1) DC Power Supply +36V at 15 amps	}	required when not using internal supplies refer to para.16.
(2) DC Power Supply +40V at 100 milliamps		

 - (3) RF Power Meter (Example: Bird Thruline Model 43 with 250W head).
 - (4) 50 ohm, 250W Dummy Load. (Example: Bird Model 8141).
 - (5) Valve Voltmeter. (Example: Marconi TF1041C).
 - (6) Variable resistor load 3 ohm 135W rating.
 - (7) Variable resistor load 10 ohm 35W rating.
 - (8) RF Drive Source, 10mW minimum output, 2MHz - 30MHz. (Example: Racol MA.1720).
 - (9) Accessory Kit CA607 containing:-
 - (i) 1 set of Module RF and DC Connectors
 - (ii) Combiner Patch Lead Assembly
 - (iii) Extension Lead Assembly.

FAULT LOCATION PROCEDURE

3. Any fault on the TA.1813 can be very quickly located to a particular sub-unit using the front panel facilities provided.
4. Each RF module has a green lamp indicating that the DC supply is present, and a clear lamp which is illuminated when the module is radiating RF. A meter is included to show the current and voltage levels, and RF monitoring points are included at each stage to provide check facilities, using an oscilloscope or spectrum analyser. The RF input and RF output powers (both forward and reflected) are also indicated on a meter.
5. If a malfunction occurs, the following should be checked:-
 - (i) All module green lights are illuminated.
 - (ii) All module clear lights are illuminated when the amplifier is driven.
 - (iii) Individual module currents and voltages.

- (iv) RF input power.
- (v) RF output power (forward and reflected).

The sequence of checks outlined in Tables 1 and 2 will, in conjunction with the previous checks, locate the fault quickly to the Power Supplies, Stabilizer Unit, RF Modules, Combining Unit, Distribution Amplifier or Splitter Unit.

TABLE 1

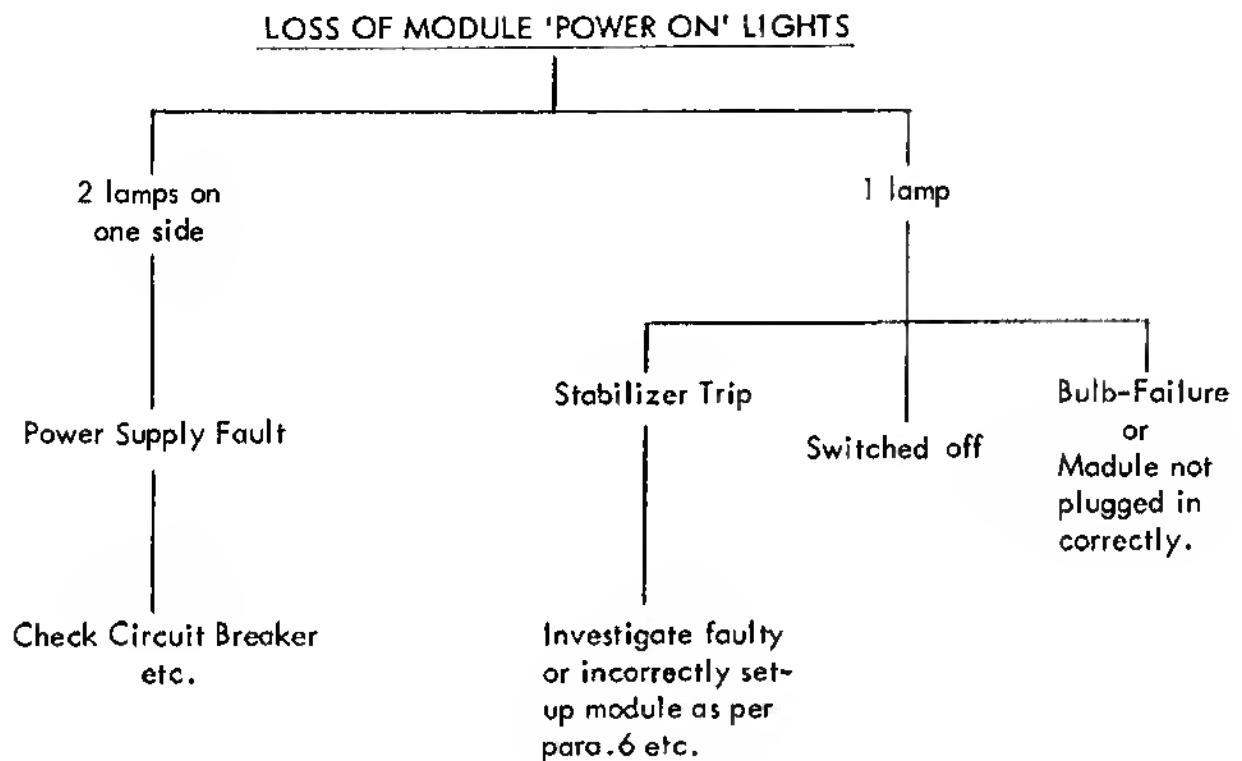
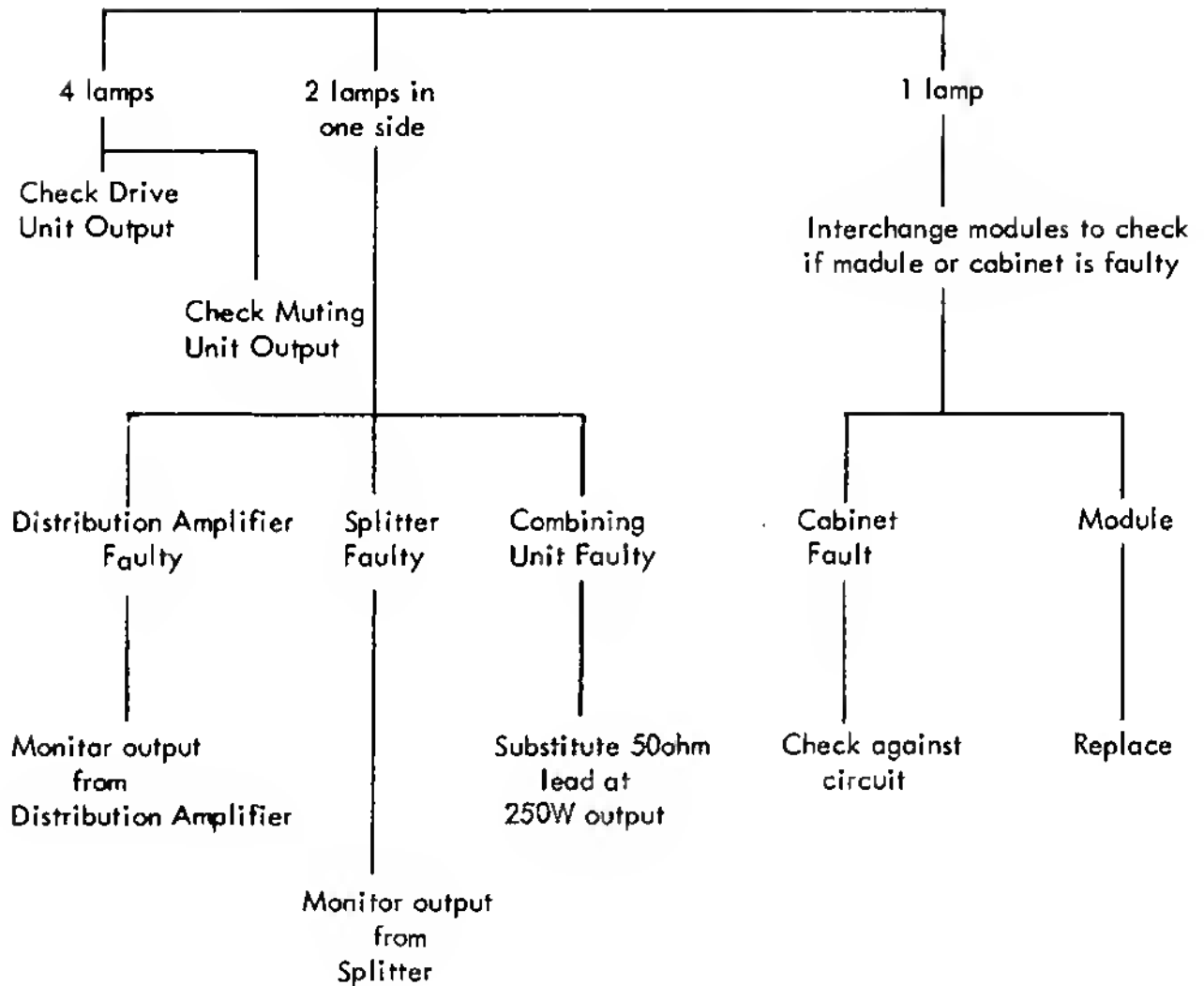


TABLE 2

LOSS OF MODULE RF OUTPUT LIGHT



Sub-Unit Fault Location

6. Fault location on sub-units is a fairly simple process; in most cases it is merely a matter of checking against the circuit diagram. The exception is the RF Amplifier Module Type MM420, and procedures for detailed circuit checking are described below.

Fault Location - RF Module MM420

7. When a faulty module has been identified it is recommended that it be replaced and subsequent fault location carried out away from the transmitter. (Refer to Chapter 7, para. 16).

RF Module Checks - Without RF Drive

8. Remove module from cabinet and set switch on module to the ON position. Measure the impedance of the +30V supply input to earth, using a multimeter (Avo type). If the impedance is less than 10 ohm an abnormal condition is indicated, and the module circuits should be investigated. If the impedance appears satisfactory the setting of the Stabilizer Trip level (para. 18) should be checked, followed by the module checks with RF drive (paras. 9 to 14).

RF Module Checks - With RF Drive

9. Check that the +30V supply current (to the High Level Board) is approximately 8A to 12A dependent on the drive frequency. Even if the current measured appears to be correct it is advisable to check all RF power transistors by measuring each emitter voltage (from each transistor stud to earth).

NOTE: Ensure transistor stud is not earthed or the transistor may be destroyed. The eight output transistors should be equal within 0.1V. Typical voltages are approximately 0.6V but are slightly dependent on the drive level and frequency applied.

10. If zero voltage or a significantly low voltage exists, the appropriate transistor should be changed using the procedure described in Chap. 6 Para. 26.
11. If a discrepancy of more than 0.1V exists, then checks on RF drive levels to the transistor must be made, following logically the RF signal path as given in the circuit diagram. Typical causes could be bias voltage errors or circuit dry joints.
12. Measurements of RF gain on both the Low Level Board and overall module are sometimes necessary to locate a low gain stage. When checked at 10MHz below the A.L.C. operating level the input signal for a 100W output should be between 250mV and 400mV injected at the module input socket.
13. With the Low Level Board terminated in a 50 ohm 2W non-inductive resistor, and isolated from the High Level Board, its output should be 2W for an input signal of not more than 10mW, injected at the module input socket.
14. When the low gain stage is located, detailed DC measurements on individual components will enable easy identification of the fault.

ALIGNMENT PROCEDURES

Adjustments to RF Module MM420

15. Following repair work and/or component replacement, it is necessary to carry out the complete adjustment procedure (paras. 17 to 23) on the RF Module, to ensure that all operating and protection levels are correct. Unless the procedure is correctly carried out the RF module may not be performing to its specification and may suffer further malfunction if not adequately protected due to incorrect settings. In addition it may periodically be necessary to carry out a routine check of the module performance. In such cases, the following procedure should be carried out.

16. For the purpose of setting-up and re-aligning, the module may be operated completely separately from the main amplifier using items (1), (2), (4) and the Module D.C. Connectors (part of Accessory Kit CA607 - item (9)) of the test equipment listed in para. 1. Alternatively the MM420 can be operated out of the transmitter cabinet by using the Extension Lead Assembly (part of Accessory Kit CA607) to connect to the TA.1813 supplies. If the second procedure is used, the TA.1813 should be operated as two separate 250W units and the second module associated with the one under test should be switched off.

NOTE: Since the module is operated outside the cabinet it will not be forced air cooled, therefore it is recommended that it is not operated for more than 20 minutes at full power. If, however, this time is greatly exceeded the module thermostat will operate to avoid overheating.

Setting-up the Stabilizer Output Volts

17. Check the nominal 30V supply at tags 2 and 1 of TS1. Adjust 4AR10 on the Stabilizer Unit to set this voltage to 30.5 volts. Check the nominal 20V supply at tags 3 and 1 of TS1. Adjust 4AR16 on the Stabilizer Unit to set this voltage to 20 volts.

Setting-up the Stabilizer Trip Level

18. Switch off the module and disconnect it from the supply. Set 4AR3 on the Stabilizer fully anti-clockwise and connect an external load resistor (item (6) of the test equipment) between tag 1 and tag 2 of TS1 without disconnecting the Stabilizer from the module. Reconnect the module to the supply and switch on the supply, adjust the load resistor for a reading of 18.5 to 19 amp, indicated on an ammeter connected in series with the +36V supply, or for a reading of 16.5 to 17 amp. on the front panel meter of the TA.1813 (switched to the appropriate module). Slowly adjust 4AR3 clockwise until the stabilizer trip circuit operates. Remove external load resistor.

19. The trip circuit for the +20V supply is pre-set on manufacture. To check the action of the trip circuit, switch off the module and disconnect it from the supply. Connect an external load resistor (item (7) of the test equipment) in series with an ammeter (set to read 5A FSD) between tags 1 and 3 of TS1. Reconnect the module to the supply and switch on the supply. Increase the load current by adjusting the external load resistor and note that the trip circuit operates between 3 and 3.5 amps.

NOTE: The current must not be adjusted to exceed 4 amps.

Setting-up Module Over Voltage - Low Level Trip

NOTE: Before applying RF to the module the supply voltage must be set to 30.5V by adjustment of 4AR10.

20. Monitor the nominal 30V supply between Tags 2 and 1 on TS1, and adjust 4AR10 to increase the output voltage. Check that the over voltage trip operates between 32.5 and 33.5 volts. This adjustment should be carried out with the module undriven. In no circumstances should the output voltage be increased above 34 volts. If the trip does not operate at the specified levels, slowly adjust 5CR1 on the protection board until it does so.

Setting-up the V.S.W.R. Detectors

21. Before setting-up the Reflected and Forward Power Levels the VSWR detectors on each individual RF Module should be balanced. Connect the RF output socket of the module to a 50 ohm load.

NOTE: It is important that a true 50 ohm resistive load is used.

Apply an RF signal at 10MHz to the module, switch on the module and increase the level of drive signal until the module is delivering 100W into the load. Connect a multimeter (set to read d.c. volts) between pin 10 on the Low Level PCB and earth. Adjust 5DC3 on the VSWR PCB (through the access hole in the cover) for a minimum reading on the multimeter, this should be between 0.4 and 0.6V.

NOTE: The cover of the VSWR PCB must always be in position when the module is operating.

Setting-up Reflected Power Level

22. Set 5AR6 on the Low Level Board (PS351) fully clockwise. Disconnect the RF output socket 5PL2 and apply an RF input signal of 10MHz at a level of 2mW. Check that the DC current does not exceed 3 amps. if measured on the front panel meter, or 5 amps, if measured on an ammeter connected in series with the 36V supply. If these values are exceeded a fault condition exists and must be corrected before proceeding further.

23. Apply a short circuit at the RF output connector, increase the RF drive level to approximately 10mW and adjust 5AR6 to obtain a reading of 6.5 amp. on the front panel meter or 8.5 amp. on an ammeter connected in series with the 36V supply. Remove the short circuit and re-connect the RF output load.

NOTE: It is important that the short circuit is applied at the RF output connector 5PL2 and not at an earlier point in the output circuit.

Setting-up the Forward Power Level

24. Set the drive signal to 18MHz at a level of 10mW. Set the module output power to 135 watts (into a 50 ohm dummy load) by adjusting 5AR1 on the module Low Level Board. Check that as the frequency is raised from 1.6 to 30MHz (at 10mW input) the output does not exceed 150W or drop below 120W.

Setting-up and Adjustment of V.S.W.R. Unit MS447

25. This unit should be set up with the TA.1813 operating into a 50 ohm dummy load at full power. With the reflected power meter selected, observe the indicator. If this exceeds 25 watts, (and the load is 50 ohm) then the VSWR unit is unbalanced. Adjust C3 for a null at an operating frequency of 10MHz. If the null cannot be reduced to 25W or below switch off and remove the unit. Carry out detailed d.c. measurements against the circuit diagram to check diodes, resistors etc.

Setting-up the Meter Panel

26. After setting-up the VSWR Unit MS447 (and with the RF output still connected to a dummy load) the transmitter output power should be measured on a power meter. With switch 11SA (located in the meter panel) set to NORMAL, the meter panel potentiometer 11AR1 should be adjusted to give the same power indication on the upper scale of the front panel meter (with meter switch set to FORWARD POWER) as that measured on the RF power meter. Switch off a number of modules until the forward power indication on the meter drops to below 250 watts. Set switch 11SA to CALIBRATE and the meter panel switch to REFLECTED POWER, adjust 11AR2 on the meter panel to obtain the same reading on the lower scale of the meter as the forward power reading on the upper scale.

27. If the VSWR warning indication is being used, this can now be set up by adjusting the indicated reflected power to the required warning level by switching off modules or adjusting the drive level and adjusting 11R12 until the warning signal is just given. Set switch 11SA back to NORMAL.

Setting-up and Adjustment of the Combining Unit MS126

28. As described in Chapter 5, all adjustments to the Combining Unit are carefully set up in the factory prior to dispatch; re-alignment is not normally necessary. Only in the very rare occurrence of a transformer requiring to be replaced should this unit need to be re-set. The procedure requires the use of specialized equipment such as Rhode and Schwarz Polyscop. Using such an equipment adjustment of the relevant coils should be made to achieve a compromise of matched input impedance and isolation over the frequency range.

CHAPTER 8 COMPONENTS LIST

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>CABINET ASSEMBLY</u>						
<u>Resistors (ohm)</u>						
1R1	Not Used					
1R2	Not Used					
1R3	Not Used					
1R4	Not Used					
1R5	51	Metal Oxide		5	907490	Electrasil TR5
<u>Capacitors (uF)</u>						
1C1	4		440V	10	Supplied	'Motor Run' Capacitors Ltd.
1C2	4		440V	10	with	
					1BL1&1BL2	
1C3	22	Electrolytic	100V	-10 +50	922186	Erie
1C4	22	Electrolytic	100V	-10 +50	922186	Erie
<u>Diodes</u>						
1D1		1N4002			911460	Texas
1D2		1N4002			911460	Texas
<u>Relays</u>						
1RLA	Not Used					
1RLB	Not Used					
1RLC	Not Used					
1RLD		Remote co-axial (26V d.c.)			921770	Dawkey Series 60
1RLE		Remote co-axial (26V d.c.)			921770	Dawkey Series 60
1RLF		Remote co-axial (26V d.c.)			921770	Dawkey Series 60
1RLG		Remote co-axial (26V d.c.)			921770	Dawkey Series 60
<u>Blowers</u>						
1BL1		Centrifugal			BD603418	Racal
1BL2		Centrifugal			BD603418	Racal
1BL3		6" dia. Axial			CD31502	Racal

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>CABINET ASSEMBLY (Continued)</u>						
<u>Connectors</u>						
1PL1		Coaxial 50 ohm			905031	Transradio BN7/5
1PL2		Coaxial 50 ohm			905031	Transradio BN7/5
1PL3		Coaxial 50 ohm			905031	Transradio BN7/5
1PL4		Coaxial 50 ohm			905031	Transradio BN7/5
1PL5	Not Used					
1PL6	Not Used					
1PL7	Not Used					
1PL8	Not Used					
1PL9		Coaxial 50 ohm			905031	Transradio BN7/5
1PL10	Not Used					
1PL11		Coaxial 50 ohm			905031	Transradio BN7/5
1PL12	Not Used					
1PL13		Coaxial 50 ohm			905031	Transradio BN7/5
1PL14	Not Used					
1PL15		Coaxial 50 ohm			905031	Transradio BN7/5
1PL16	Not Used					
1PL17		Coaxial 50 ohm			922179	Transradio C7/5
1PL18		Coaxial 50 ohm			922179	Transradio C7/5
1PL19		Coaxial 50 ohm			901716	Transradio C1/5
1PL20		Coaxial 50 ohm			901716	Transradio C1/5
1PL21		Coaxial 50 ohm			901716	Transradio C1/5
1PL22		Coaxial 50 ohm			901716	Transradio C1/5
1PL23		Coaxial 50 ohm			922179	Transradio C7/5
1PL24		Coaxial 50 ohm			922179	Transradio C7/5
1PL25		Coaxial 50 ohm			922179	Transradio C7/5
1PL26		Coaxial 50 ohm			922179	Transradio C7/5
1PL27		Coaxial 50 ohm			905031	Transradio BN7/5
1PL28		Coaxial 50 ohm			900038	Transradio BN1/5
1SK1		15-way 'D'			900905	Cannon DA15S
1SK2		25-way Pattern 102			921506	Belling Lee L1328/ 5/AG
1SK3		15-way 'D'			900905	Cannon DA15S
1SK4		25-way 'D'			915970	Cannon DB25S
1SK5		16-way			920178	Amphenol 26-190-16

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>Connectors (contd)</u>		<u>CABINET ASSEMBLY (Continued)</u>				
1SK 6		16-way			920178	Amphenol 26-190-16
1SK 7		16-way			920178	Amphenol 26-190-16
1SK 8		16-way			920178	Amphenol 26-190-16
1SK 9	Not Used					
1SK 10	Not Used					
1SK 11	Not Used					
1SK 12	Not Used					
1SK 13		Coaxial 50 ohm			912050	Radiall R15000
1SK 14		Coaxial 50 ohm			912050	Radiall R15000
1SK 15		Coaxial 50 ohm			912050	Radiall R15000
1SK 16		Coaxial 50 ohm			912050	Radiall R15000
1SK 17		Coaxial 50 ohm			912050	Radiall R15000
1SK 18		Coaxial 50 ohm			912050	Radiall R15000
1SK 19		Coaxial 50 ohm			912050	Radiall R15000
1SK 20		Coaxial 50 ohm			912050	Radiall R15000
1SK 21 to 1SK 28	} Not Used					
1SK 29		Coaxial 50 ohm			908387	Transradio BN5/5A
1SK 30		50-way 'D'			900574	Cannon DD50S
1SK 31		9-way 'D'			918090	Cannon DE9S
1SK 32		Coaxial 50 ohm			912258	Transradio BN2/5B
1SK 33		Coaxial 50 ohm			918394	Transradio BN2/5A
1LK 1		Adaptor Plug coaxial 50 ohm			922215	Transradio C8/5
1LK 2		Adaptor Plug coaxial 50 ohm			922215	Transradio C8/5
1LK 3		Adaptor Socket coaxial 50 ohm			922214	Transradio C3/5A
1LK 4		Adaptor Plug coaxial 50 ohms			922215	Transradio C8/5
1LK 5		Adaptor Plug coaxial 50 ohms			922215	Transradio C8/5
<u>Terminals</u>						
1TB 1		6-way 40A			922932	Klippon MK6/6
1TB 2	Not Used					
1TB 3	Not Used					
1TB 4		4-way 36A			917678	Klippon, KS4D
1TB 5		4-way 36A			917678	Klippon, KS4D

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>CABINET ASSEMBLY (Continued)</u>						
<u>Terminols (contd.)</u>						
1TB6		6-way 25A			922379	Klippon, MK3/6
1TB7		12-way 25A 110V			922181	Klippon, MK2L/12
1TB8		12-way 25A 110V			922181	Klippon, MK2L/12
1TB9		12-way 25A 110V			921768	Klippon, MK2/12
1TB10 to 1TB15	} Not Used					
1TB16		12-way 25A 110V			921768	Klippon, MK2/12

SPLITTER UNIT MS444 (and P.C. Board PS318)

Resistors (ohm)

7R1	390	Metal Oxide		5	908472	Electrosil TR4
7R2	150	Metal Oxide		5	909121	Electrosil TR4
7R3	1.2k	Metal Oxide		5	908285	Electrosil TR4
7R4	39	Metal Oxide		5	917062	Electrosil TR4
7R5	18	Metal Oxide		5	916626	Electrosil TR4
7R6	150	Metal Oxide		5	909121	Electrosil TR4
7R7	1.2k	Metal Oxide		5	908285	Electrosil TR4
7R8	390	Metal Oxide		5	908472	Electrosil TR4
7R9	51	Metal Oxide		5	917056	Electrosil TR4
7R10	51	Metal Oxide		5	917056	Electrosil TR4
7R11	1.5k	Metal Oxide		5	908296	Electrosil TR4
7R12	2.2k	Pre-set Linear			920518	Plessey, MPWT
7R13	82	Metal Oxide		5	908290	Electrosil TR4

Capacitors (uF)

7C1	.01	Fixed	25V	+50 -25	911845	Erie, 831/T/25V
7C2	10	Electrolytic	16V	-10 +50	900068	Mullard, C426AR/ E10

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>SPLITTER UNIT (Continued)</u>						
<u>Transistors</u>						
7TR1		BC107			911929	Mullard
<u>Diodes</u>						
7D1		1N4149			914898	S.T.C.
7D2		1N4002			911460	Texas
7D3		1N4002			911460	Texas
<u>Connectors</u>						
7PL1		15-way			909729	Cannon DA15P
7PL2		Coaxial 50 ohm			905031	Transradio 8N7/5
7PL3		Coaxial 50 ohm			905031	Transradio 8N7/5
7SK1		Coaxial 50 ohm			908387	Transradio 8N5/5A

DISTRIBUTION AMPLIFIER MS240 (and P.C. Board PS319)

Resistors (ohm)

8R1	470	Wirewound	2½W	5	913612	Welwyn W21
8R2	47	Metal Oxide		5	911930	Electrosil TR4
8R3	10	Metal Oxide		5	912868	Electrosil TR4
8R4	27	Metal Oxide		5	908473	Electrosil TR4
8R5	10	Metal Oxide		5	912868	Electrosil TR4
8R6	27	Metal Oxide		5	908473	Electrosil TR4
8R7	10	Metal Oxide		5	912868	Electrosil TR4
8R8	27	Metal Oxide		5	908473	Electrosil TR4
8R9	10	Metal Oxide		5	912868	Electrosil TR4
8R10	27	Metal Oxide		5	908473	Electrosil TR4
8R11	22	Wirewound	2½W	5	913580	Welwyn W21

Capacitors (uF)

8C1	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C2	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C3	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C4	27p	Fixed	500V	5	919483	Erie 831/N750
8C5	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100

Cct Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
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<u>DISTRIBUTION AMPLIFIER (Continued)</u>						
<u>Capacitors (contd.)</u>						
8C6	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C7	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C8	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C9	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C10	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C11	27p	Fixed	500V	5	919483	Erie 831/N750
8C12	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C13	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
8C14	0.1	Fixed	100V	20	914173	STC PMC2R/0.1/M100
<u>Transistors</u>						
8TR1		2N3553			916730	
8TR2		2N3553			916730	
8TR3		2N3553			916730	
8TR4		2N3553			916730	
<u>Diodes</u>						
8D1		1N4149			914898	STC
8D2		BZY88C 9V1			914899	Mullard
8D3		1N4149			914898	STC
8D4		BZY88C 9V1			914899	Mullard
8D5		1N4149			914898	STC
8D6		BZY88C 9V1			914899	Mullard
8D7		1N4149			914898	STC
8D8		BZY88C 9V1			914899	Mullard
8D9		1N4002			911460	Texas
8D10		1N4002			911460	Texas
8D11		1N4002			911460	Texas
8D12		1N4002			911460	Texas
<u>Transformers</u>						
8T1					CT603608	Racal
8T2					CT603607	Racal
8T3					CT603608	Racal
8T4					CT603607	Racal
8T5					CT603608	Racal

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Port Number	Manufacturer
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DISTRIBUTION AMPLIFIER (Continued)

Transformers (contd.)

8T6					CT603607	Racal
8T7					CT603607	Racal
8T8					CT603608	Racal

Connectors

8PL1		Connector 15-way			909729	Cannon DA15P
8SK1		Connector 50Ω			908387	BN5/5A
8SK2		Connector 50Ω			908387	8N5/5A
8SK3		Connector 50Ω			908387	BN5/5A
8SK4		Connector 50Ω			908387	BN5/5A
8SK5		Connector 50Ω			908387	8N5/5A
8SK6		Connector 50Ω			908387	BN5/5A

OVERLOAD UNIT MS443 (and P.C. Board PS322)

Resistors (ohm)

R1	560	Wirewound	2½W	5	913614	Welwyn W21
R2	560	Wirewound	2½W	5	913614	Welwyn W21
R3	4.7k	Metal Oxide		5	906022	Electrosil TR5
R4	4.7k	Metal Oxide		5	906022	Electrosil TR5
R5	4.7k	Metal Oxide		5	906022	Electrosil TR5
R6	4.7k	Metal Oxide		5	906022	Electrosil TR5
R7	470	Metal Oxide		5	900992	Electrosil TR4
R8	470	Metal Oxide		5	900992	Electrosil TR4
R9	470	Metal Oxide		5	900992	Electrosil TR4
R10	470	Metal Oxide		5	900992	Electrosil TR4
R11	4.7k	Metal Oxide		5	906022	Electrosil TR5
R12	1k	Metal Oxide		5	919805	Electrosil TR4
R13	1k	Metal Oxide		5	919805	Electrosil TR4
R14	1k	Metal Oxide		5	919805	Electrosil TR4
R15	10k	Metal Oxide		5	900986	Electrosil TR4
R16	4.7k	Metal Oxide		5	906022	Electrosil TR5
R17	270	Metal Oxide		5	908284	Electrosil TR4
R18	1k	Metal Oxide		5	919805	Electrosil TR4
R19	8.2k	Metal Oxide		5	900986	Electrosil TR4
R20	1.5k	Metal Oxide		5	908285	Electrosil TR4

Cct. Ref.	Value	Description	Rot.	Tol. %	Racal Part Number	Manufacturer
<u>OVERLOAD UNIT (Continued)</u>						
<u>Resistors (ohm) (contd.)</u>						
R21	10k	Metal Oxide		5	900986	Electrosil TR4
R22	10k	Metal Oxide		5	900986	Electrosil TR4
R23	1k	Metal Oxide		5	919805	Electrosil TR4
R24	1k	Metal Oxide		5	919805	Electrosil TR4
R25	10k	Metal Oxide		5	900986	Electrosil TR4
R26	10k	Metal Oxide		5	900986	Electrosil TR4
R27	47k	Metal Oxide		5	908391	Electrosil TR4
R28	2.2k	Metal Oxide		5	906020	Electrosil TR5
R29	4.7k	Metal Oxide		5	900989	Electrosil TR4
R30	4.7k	Metal Oxide		5	900989	Electrosil TR4
R31	4.7k	Metal Oxide		5	900989	Electrosil TR4
R32	10k	Metal Oxide		5	900986	Electrosil TR4
R33	10k	Metal Oxide		5	900986	Electrosil TR4
R34	10k	Metal Oxide		5	900986	Electrosil TR4
R35	4.7k	Metal Oxide		5	906022	Electrosil TR5
R36	4.7k	Metal Oxide		5	900989	Electrosil TR4
<u>Capacitors (uF)</u>						
C1	0.1	Fixed	100V	20	914173	ITT, PMC2R
C2	0.1	Fixed	100V	20	914173	ITT, PMC2R
C3	0.1	Fixed	100V	20	914173	ITT, PMC2R
C4	0.1	Fixed	100V	20	914173	ITT, PMC2R
C5	0.1	Fixed	100V	20	914173	ITT, PMC2R
C6	0.1	Fixed	100V	20	914173	ITT, PMC2R
C7	0.1	Fixed	100V	20	914173	ITT, PMC2R
C8	0.1	Fixed	100V	20	914173	ITT, PMC2R
C9	20	Electrolytic	25V	-10 +50	921354	Mullard C428AR/F20
C10	.01	Fixed	100V	20	914171	ITT, PMC2R
C11	0.1	Fixed	100V	20	914173	ITT, PMC2R
C12	0.1	Fixed	100V	20	914173	ITT, PMC2R
C13	0.1	Fixed	100V	20	914173	ITT, PMC2R
<u>Diodes</u>						
D1		8ZY88C18			915920	Mullard
D2		BZY88C18			915920	Mullard
D3		BZY88C18			915920	Mullard
D4		BZY88C18			915920	Mullard
D5		1N4149			914898	STC

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>OVERLOAD UNIT (Continued)</u>						
<u>Diodes (contd.)</u>						
D6		BZY88C6V8			914064	Mullard
D7		8ZY88C6V8			914064	Mullard
D8		8ZY88C5V6			912747	Mullard
D9		1N4149			914898	STC
D10		BZY88C12			914310	Mullard
D11		1N4149			914898	STC
<u>Transistors</u>						
TR1		BC107			911929	Mullard
TR2		BC107			911929	Mullard
TR3		8C107			911929	Mullard
TR4		8C107			911929	Mullard
TR5		BC107			911929	Mullard
TR6		8C107			911929	Mullard
TR7		8C107			911929	Mullard
TR8		8C107			911929	Mullard
TR9		8C107			911929	Mullard
TR10		BC107			911929	Mullard
TR11		BC107			911929	Mullard
TR12		8C107			911929	Mullard
TR13		BC107			911929	Mullard
<u>Connectors</u>						
PL1		25-way			916489	Cannon D825P

CABINET V.S.W.R. UNIT MS447 (and P.C. Board PS317)

Resistors (ohm)

R1	22	Metal Oxide	5	922070	Electrosil TR8
R2	22	Metal Oxide	5	922070	Electrosil TR8
R3	22	Metal Oxide	5	922070	Electrosil TR8
R4	22	Metal Oxide	5	922070	Electrosil TR8

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
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CABINET VSWR UNIT (Continued)

Capacitors (uF)

C1	2pF	Ceramic Disc		0.5pF	920558	Plessey Type 10
C2	0.1	Fixed	100V	20	914173	ITT, PMC2R
C3	4-60pF	Dielectric Trimmer	200V		916940	Mullard, 809-07011
C4	150pF	Fixed			902238	Lemco, MS199/M
C5	0.1	Fixed	100V	20	914173	ITT, PMC2R
C6	0.1	Fixed	100V	20	914173	ITT, PMC2R
C7	0.1	Fixed	100V	20	914173	ITT, PMC2R
C8	1000pF	Feed-through		20	907011	Erie 361K2600
C9	1000pF	Feed-through		20	907011	Erie 361K2600

Diodes

D1	1N4149			914898	Mullard
D2	1N4149			914898	Mullard
D3	1N4149			914898	Mullard
D4	1N4149			914898	Mullard

Inductors

L1	Coil Assembly			BT603391	Racal
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Connectors

SK1				917555	Transradio C4/5CH
SK2				917555	Transradio C4/5CH

METER PANEL MS445

Switches

SA				8SW603464	Racal
S8				BSW603463	Racal
SC				BSW603463	Racal

Meters

ME1				AD603409	Racal
ME2				AD603410	Racal

Connectors

PL1	50-way			900577	Cannan DD50P
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Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
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METER PANEL (Continued)

Resistors (ohm)

R1	220k	Metal Oxide		2	921771	Electrosil TR4
R2	220k	Metal Oxide		2	921771	Electrosil TR4
R3	10k	Metal Oxide		2	914042	Electrosil TR4
R4	180k	Metal Oxide		2	920644	Electrosil TR4
R5	180k	Metal Oxide		2	920644	Electrosil TR4
R6	10k	Metal Oxide		2	914042	Electrosil TR4

VSWR WARNING P.C. Board PS446

Resistors (ohm)

R1	22k	Pre-set linear			919816	Plessey MPWT Dealer
R2	22k	Pre-set Linear			919816	Plessey MPWT Dealer
R3	2.2k	Metal Oxide		5	908270	Electrosil TR4
R4	1k	Metal Oxide		5	908267	Electrosil TR4
R5	22k	Metal Oxide		5	908269	Electrosil TR4
R6	27k	Metal Oxide		5	908295	Electrosil TR4
R7	27k	Metal Oxide		5	908295	Electrosil TR4
R8	4.7k	Metal Oxide		5	900989	Electrosil TR4
R9	470	Metal Oxide		5	900992	Electrosil TR4
R10	4.7k	Metal Oxide		5	900989	Electrosil TR4
R11	10k	Metal Oxide		5	900986	Electrosil TR4
R12	4.7k	Pre-set linear		20	921023	Plessey MPWT Dealer
R13	22k	Metal Oxide		5	908269	Electrosil TR4
R14	10k	Metal Oxide		5	900986	Electrosil TR4
R15	1k	Metal Oxide		5	908267	Electrosil TR4

Capacitors (uF)

C1	0.1	Fixed	100V	20	914173	STC, PMC2R
C2	0.1	Fixed	100V	20	914173	STC, PMC2R
C3	0.1	Fixed	100V	20	914173	STC, PMC2R

Transistors

TR1	BC107				911929	Mullard
TR2	BC107				911929	Mullard
TR3	BC107				911929	Mullard
TR4	BCY71				911928	Mullard

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
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VSWR WARNING P.C.Board (Continued)

Inductors

L1	10uH				921609	Painton 58/10/0011/ 10
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Switches

S1		2-position, c/a			915644	EMI T15014/001
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RF POWER MODULE - MM420 CHASSIS

Resistors (ohms)

5R1	0.1	Fixed		5	920183	CGS HSA5
5R2	0.1	Fixed		5	920183	CGS HSA5
5R3	1k	Metal Oxide		5	906031	Electrasil TR5
5R4	220	Metal Oxide		5	906544	Electrasil TR5

Capacitors (uF)

5C1	0.1	Fixed	100V	20	914173	ITT, PMC2R
5C2	47	Tantalum	35V	20	917478	STC, LWA/403/KA
5C3	6.8pF	Disc Ceramic	500V	0.5pF	919457	Erie 831/NPO
5C4	18pF	Ceramic	750V	5	902017	Erie P100B

Diodes

5D1		1N4002			911460	Texas
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Transformers

5T1		RF Mon. Toroid			BT603397	Racal
5T2		VSWR Toroid			BT603391	Racal

Inductors

5L1		Ferrite Core			919244	Neosid, F14
5L2		Choke			900760	Painton, C4

Connectors

5PL1		Coaxial			912192	Radiall R15510
5PL2		Coaxial			912192	Radiall R15510
5SK3		Coaxial			905449	Transradio BN5/5B

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>RF POWER MODULE (Continued)</u>						
<u>Miscellaneous</u>						
5CSR1		Thyristar, 12RCM10			920129	Int. Rectifiers
5THE1		Thermostat			AD602957	Racal
5RLA		Relay 26.5V			921683	Clare Elliott, G24
5PL1		Lamp 28V, 0.04A			918756	Guest, 727T
5PL2		Lamp, 28V, 0.04A			918756	Guest, 727T
5FS1		Fuse, 17A (L350/16)			920921	Int. Rectifiers
5SA		Switch, DPDT			917716	NSF

LOW LEVEL BOARD PS351

Resistors (ohms)

5AR1	100k	Pre-set linear			920057	Plessey, MPWT Dealer
5AR2	4.7k	Metal Oxide	5		900989	Electrasil TR4
5AR3	4.7k	Metal Oxide	5		900989	Electrasil TR4
5AR4	100k	Metal Oxide	5		908293	Electrasil TR4
5AR5	47k	Metal Oxide	5		908391	Electrasil TR4
5AR6	10k	Variable	5		919815	Plessey MPWT Dealer
5AR7	2.2k	Metal Oxide	5		908270	Electrasil TR4
5AR8	2.2k	Metal Oxide	5		908270	Electrasil TR4
5AR9	2.2k	Metal Oxide	5		908270	Electrasil TR4
5AR10	10k	Metal Oxide	5		900986	Electrasil TR4
5AR11	100	Metal Oxide	5		908276	Electrasil TR4
5AR12	10k	Metal Oxide	5		900986	Electrasil TR4
5AR13	2.2k	Metal Oxide	5		908270	Electrasil TR4
5AR14	47k	Metal Oxide	5		908391	Electrasil TR4
5AR15	2.2k	Metal Oxide	5		908270	Electrasil TR4
5AR16	27k	Metal Oxide	5		908295	Electrasil TR4
5AR17	18k	Metal Oxide	5		908272	Electrasil TR4
5AR18*	100k	Metal Oxide	5		907866	Electrasil TR5
5AR18**	1M	Metal Oxide	5		914036	Electrasil TR4
5AR19	47	Wirewound	5		913588	Welwyn W21
5AR20	1k	Metal Oxide	5		908267	Electrasil TR4

* Used on Version DC604137/A Board only.

** Used on Version DC604137/B Board only.

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>LOW LEVEL BOARD (Continued)</u>						
<u>Resistors (ohms) (contd.)</u>						
5AR21	47k	Metal Oxide		5	908391	Electrosil TR4
5AR22	470	Metal Oxide		5	906019	Electrosil TR5
5AR23	1k	Metal Oxide		5	908267	Electrosil TR4
5AR24	4.7k	Metal Oxide		5	900989	Electrosil TR4
5AR25	220	Metal Oxide		5	900988	Electrosil TR4
5AR26	47	Metal Oxide		5	911930	Electrosil TR4
5AR27	1k	Metal Oxide		5	908267	Electrosil TR4
5AR28	1k	Metal Oxide		5	908267	Electrosil TR4
5AR29	2.2k	Metal Oxide		5	908270	Electrosil TR4
5AR30	Not Used					
5AR31	820	Metal Oxide		5	906024	Electrosil TR5
5AR32	56	Metal Oxide		5	908289	Electrosil TR4
5AR33	1k	Metal Oxide		5	908267	Electrosil TR4
5AR34	330	Wirewound	2½W	5	913608	Welwyn W21
5AR35	27	Metal Oxide		5	908473	Electrosil TR4
5AR36	Not Used					
5AR37	10	Metal Oxide		5	912868	Electrosil TR4
5AR38	22	Metal Oxide		5	911495	Electrosil TR4
5AR39	100	Metal Oxide		5	913962	Electrosil TR6
5AR40	10	Metal Oxide		5	912868	Electrosil TR4
5AR41	10	Metal Oxide		5	912868	Electrosil TR4
5AR42	10	Metal Oxide		5	912868	Electrosil TR4
5AR43	10	Metal Oxide		5	912868	Electrosil TR4
5AR44	100	Metal Oxide		5	913962	Electrosil TR6
5AR45	10	Metal Oxide		5	912868	Electrosil TR4
5AR46	22	Metal Oxide		5	911495	Electrosil TR4
5AR47	Not Used					
5AR48*	10	Metal Oxide		5	908471	Electrosil TR5
5AR48**	27	Metal Oxide		5	906341	Electrosil TR5
5AR49**	270	Metal Oxide		5	908143	Electrosil TR5
5AR50*	10	Metal Oxide		5	908471	Electrosil TR5
5AR50**	27	Metal Oxide		5	906341	Electrosil TR5

* Used on Version DC604137/A Board only.

** Used on Version DC604137/B Board only.

Cct. Ref.	Value	Description	Rot.	Tol. %	Rocal Part Number	Manufacturer
<u>LOW LEVEL BOARD (Continued)</u>						
<u>Resistors (ohms) (contd.)</u>						
SAR51**	270	Metal Oxide		5	908143	Electrosil TR5
SAR52	4.7k	Metal Oxide		5	900989	Electrosil TR4
SAR53	33k	Metal Oxide		5	908291	Electrosil TR4
SAR54**	1k	Metal Oxide		5	908267	Electrosil TR4
<u>Capacitors (uF)</u>						
SAC1	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC2	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC3	100	Electrolytic	20V	20	913970	ITT,TAA
SAC4	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC5	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC6	1000pF	Fixed		20	915243	Erie 831K2600
SAC7	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC8	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC9	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC10	100	Electrolytic	20V	20	913970	ITT,TAA
SAC11	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC12*	10	Electrolytic		20	905399	ITT,TAA B/10/M20
SAC13	Not Used					
SAC14	0.01	Fixed	25V	+50 -25	911845	Erie 831/T
SAC15	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC16	0.01	Fixed	25V	+50 -25	911845	Erie 831/T
SAC17	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC18	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC19	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC20	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC21	0.01	Fixed	25V	+50 -25	911845	Erie 831/T
SAC22	0.1	Fixed	100V	20	914173	ITT,PMC2R
SAC23	0.01	Fixed	25V	+50 -25	911845	Erie 831/T
SAC24	0.01	Fixed	25V	+50 -25	911845	Erie 831/T
SAC25	0.1	Fixed	100V	20	914173	ITT,PMC2R

* Used on Version DC604137/A Board only.

** Used on Version DC604137/B Board only.

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>LOW LEVEL BOARD (Continued)</u>						
<u>Capacitors (uF) (contd.)</u>						
5AC26	0.01	Fixed	25V	+50 -25	911845	Erie 831/T
5AC27	0.1	Fixed	100V	20	914173	ITT, PMC2R
5AC28	0.1	Fixed	100V	20	914173	ITT, PMC2R
5AC29	0.1	Fixed	100V	20	914173	ITT, PMC2R
5AC30	0.01	Fixed	25V	+50 -25	911845	Erie, 831/T
5AC31	0.1	Fixed	100V	20	914173	ITT, PMC2R
5AC32	0.01	Fixed	25V	+50 -25	911845	Erie 831/T
5AC33	0.1	Fixed	100V	20	914173	ITT, PMC2R
5AC34	Not Used					
5AC35	Not Used					
5AC36	Not Used					
5AC37	470pF	Fixed		10	914325	Erie H1-K AD
5AC38	470pF	Fixed		10	914325	Erie H1-K AD
5AC39	470pF	Fixed		10	914325	Erie H1-K AD
5AC40	470pF	Fixed		10	914325	Erie H1-K AD
5AC41	0.1	Fixed	100V	20	914173	ITT, PMC2R
5AC42	0.1	Fixed	100V	20	914173	ITT, PMC2R
5AC43**	0.01	Fixed	25V	+50 -25	911845	Erie 831/T
5AC44**	0.01	Fixed	25V	+50 -25	911845	Erie 831/T
5AC45	4.5-20pF	Variable			910061	Steatite 7S
5AC46	33pF	Disc Ceramic		5	919459	Erie 831/N750

** Used on Version DC604137/B Board only.

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>LOW LEVEL BOARD (Continued)</u>						
<u>Transistors</u>						
5ATR1		BC107			911929	Mullard
5ATR2		BC107			911929	Mullard
5ATR3		BC107			911929	Mullard
5ATR4		BCY71			911928	Mullard
5ATR5		BC107			911929	Mullard
5ATR6		BFY51			908753	Mullard
5ATR7		BFY51			908753	Mullard
5ATR8		BC107			911929	Mullard
5ATR9		BFY51			908753	Mullard
5ATR10		BCY71			911928	Mullard
5ATR11		BFY51			908753	Mullard
5ATR12		BFX29			915267	Mullard
5ATR13		BFY51			908753	Mullard
5ATR14	Not Used					
5ATR15		2N3553			916730	Mullard
5ATR16		2N3553			916730	Mullard
5ATR17		2N3553			916730	Mullard
5ATR18		2N3866			917219	Mullard
5ATR19		2N3866			917219	Mullard
5ATR20		2N3553			916730	Mullard
5ATR21		2N3553			916730	Mullard
5ATR22		2N3553			916730	Mullard
5ATR23	Not Used					
5ATR24**		BC107			911929	Mullard
5ATR25**		BC107			911929	Mullard
<u>Diodes</u>						
5AD1		1N4149			914898	STC
5AD2		1N4149			914898	STC
5AD3		BZY88C5V1			912059	Mullard
5AD4		BZY88C5V1			912059	Mullard
5AD5		1N4149			914898	STC

** Used on Version DC604137/B Board only.

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>LOW LEVEL BOARD (Continued)</u>						
<u>Diodes (contd.)</u>						
5AD6		1N4149			914898	STC
5AD7		1N4149			914898	STC
5AD8		1N4149			914898	STC
5AD9		1N4149			914898	STC
5AD10*		1N4149			914898	STC
5AD11		1N4149			914898	STC
5AD12		1N4149			914898	STC
5AD13		1N4149			914898	STC
5AD14**		1N4149			914898	STC
5AD15		1N4002			911460	Texas
5AD16		1N4002			911460	Texas
5AD17 *		1N4149			914898	STC
5AD18*		1N4149			914898	STC
5AD19	Nat Used					
5AD20		BZY88C10			917217	Mullard
<u>Transformers</u>						
5AT1		Output			CT603360	Racal
5AT2		Interstage			CT603358	Racal
5AT3		Interstage			CT603358	Racal
5AT4		Input			CT603357	Racal
<u>Miscellaneous</u>						
5AFB1		Ferrite Bead			907488	Mullard FX1242
5AFB2		Ferrite Bead			907488	Mullard FX1242
5AFB3		Ferrite Bead			907488	Mullard FX1242
5AFB4		Ferrite Bead			907488	Mullard FX1242
5AFB5		Ferrite Bead			907488	Mullard FX1242
5AFB6		Ferrite Bead			907488	Mullard FX1242

* Used on Version DC604137/A Baard only.

** Used on Version DC604137/B Baard only.

Cct. Ref.	Value	Description	Rot.	Tol. %	Rocol Port Number	Manufacturer
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HIGH LEVEL BOARD PS315

Resistors (ohms)

5BR1	180	Wirewound	2½W	5	913602	Welwyn W21
5BR2	47	Wirewound	9W	5	913738	Welwyn W23
5BR3	1.5	Wirewound	2½W	5	917139	Welwyn W21
5BR4	10	Wirewound	2½W	5	913571	Welwyn W21
5BR5	470	Metal Oxide		5	906019	Electrosil TR5
5BR6	1	Metal Film		2	921418	Beyschlag MBE
5BR7	1	Metal Film		2	921418	Beyschlag MBE
5BR8	100	Metal Oxide		5	907491	Electrosil TR5
5BR9	100	Metal Oxide		5	907491	Electrosil TR5
5BR10	1	Metal Film		2	921418	Beyschlag MBE
5BR11	1	Metal Film		2	921418	Beyschlag MBE
5BR12	470	Metal Oxide		5	906019	Electrosil TR5
5BR13	1	Metal Film		2	921418	Beyschlag MBE
5BR14	1	Metal Film		2	921418	Beyschlag MBE
5BR15	100	Wirewound	9W	5	913746	Welwyn W23
5BR16	100	Metal Oxide		5	907491	Electrosil TR5
5BR17	100	Metal Oxide		5	907491	Electrosil TR5
5BR18	4.7	Wirewound	2½W	5	917145	Welwyn W21
5BR19	27	Wirewound	2½W	5	913582	Welwyn W21
5BR20	1	Metal Film		2	921418	Beyschlag MBE
5BR21	1	Metal Film		2	921418	Beyschlag MBE
5BR22	12	Metal Oxide		5	917782	Electrosil TR4
5BR23	12	Metal Oxide		5	917782	Electrosil TR4
5BR24	12	Metal Oxide		5	917782	Electrosil TR4
5BR25	12	Metal Oxide		5	917782	Electrosil TR4
5BR26	12	Metal Oxide		5	917782	Electrosil TR4
5BR27	12	Metal Oxide		5	917782	Electrosil TR4
5BR28	12	Metal Oxide		5	917782	Electrosil TR4
5BR29	12	Metal Oxide		5	917782	Electrosil TR4
5BR30	12	Metal Oxide		5	917782	Electrosil TR4
5BR31	12	Metal Oxide		5	917782	Electrosil TR4
5BR32	12	Metal Oxide		5	917782	Electrosil TR4
5BR33	12	Metal Oxide		5	917782	Electrosil TR4
5BR34	1	Metal Film		2	921418	Beyschlag MBE
5BR35	1	Metal Film		2	921418	Beyschlag MBE

Cct. Ref.	Value	Description	Rot.	Tol. %	Racal Part Number	Manufacturer
<u>HIGH LEVEL BOARD (Continued)</u>						
<u>Resistors (contd.)</u>						
5BR36	4.7	Wirewound	2½W	5	917145	Welwyn W21
5BR37	27	Wirewound	2½W	5	913582	Welwyn W21
5BR38	100	Metal Oxide		5	907491	Electrosil TR5
5BR39	100	Metal Oxide		5	907491	Electrosil TR5
5BR40	100	Wirewound	9W	5	913746	Welwyn W23
5BR41	1	Metal Film		2	921418	Beyschlag MBE
5BR 42	1	Metal Film		2	921418	Beyschlag MBE
5BR43	470	Metal Oxide		5	906019	Electrosil TR5
5BR44	1	Metal Film		2	921418	Beyschlag MBE
5BR45	1	Metal Film		2	921418	Beyschlag MBE
5BR46	100	Metal Oxide		5	907491	Electrosil TR5
5BR47	100	Metal Oxide		5	907491	Electrosil TR5
5BR48	1	Metal Film		2	921418	Beyschlag MBE
5BR49	1	Metal Film		2	921418	Beyschlag MBE
5BR50	470	Metal Oxide		5	906019	Electrosil TR5
5BR51	47	Wirewound	9W	5	913738	Welwyn W23
5BR52	1.5	Wirewound	2½W	5	917139	Welwyn W21
5BR53	10	Wirewound	2½W	5	913571	Welwyn W21
5BR54	180	Wirewound	2½W	5	913602	Welwyn W21
<u>Capacitors (uF)</u>						
5BC1	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC2	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC3	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC4	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC5	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC6	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC7	0.1	Fixed	100V	20	914173	ITT PMC2R
5CB8	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC9	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC10	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC11	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC12	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC13	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC14	0.1	Fixed	100V	20	914173	ITT PMC2R
5BC15	1000pF	Ceramicon	500V	20	915243	Erie HI-K831

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
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HIGH LEVEL BOARD (Continued)

Capacitors (uF) (contd.)

58C16	0.1	Fixed	100V	20	914173	ITT PMC2R
58C17	0.1	Fixed	100V	20	914173	ITT PMC2R
58C18	0.1	Fixed	100V	20	914173	ITT PMC2R
58C19	0.1	Fixed	100V	20	914173	ITT PMC2R
58C20	0.1	Fixed	100V	20	914173	ITT PMC2R
58C21	1000pF	Ceramic	500V	20	915243	Erie HI-K831
58C22	0.1	Fixed	100V	20	914173	ITT PMC2R
58C23	0.1	Fixed	100V	20	914173	ITT PMC2R
58C24	0.1	Fixed	100V	20	914173	ITT PMC2R
58C25	0.1	Fixed	100V	20	914173	ITT PMC2R
58C26	0.1	Fixed	100V	20	914173	ITT PMC2R
58C27	0.1	Fixed	100V	20	914173	ITT PMC2R
58C28	0.1	Fixed	100V	20	914173	ITT PMC2R
58C29	0.1	Fixed	100V	20	914173	ITT PMC2R
58C30	0.1	Fixed	100V	20	914173	ITT PMC2R
58C31	0.1	Fixed	100V	20	914173	ITT PMC2R
58C32	0.1	Fixed	100V	20	914173	ITT PMC2R
58C33	0.1	Fixed	100V	20	914173	ITT PMC2R
58C34	0.1	Fixed	100V	20	914173	ITT PMC2R

Transistors

58TR1	Special Racal Type
58TR2	Special Racal Type
58TR3	Special Racal Type
58TR4	Special Racal Type
58TR5	Special Racal Type
58TR6	Special Racal Type
58TR7	Special Racal Type
58TR8	Special Racal Type
58TR9	Special Racal Type
58TR10	Special Racal Type

Diodes

58D1	1N4997	920571	Matarala
58D2	1N4997	920571	Matarala
58D3	1N4149	914898	STC
58D4	1N4002	911460	Texas
58D5	1N4002	911460	Texas

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>HIGH LEVEL BOARD (Continued)</u>						
<u>Diodes (cantd.)</u>						
5BD6		1N4149			914898	STC
5BD7		1N4149			914898	STC
5BD8		1N4002			911460	Texas
5BD9		1N4002			911460	Texas
5BD10		1N4149			914898	STC
5BD11		1N4997			920571	Motorola
5BD12		1N4997			920571	Motorola
<u>Transformers</u>						
5BT1					CT603362	Racal
5BT2					CT603362	Racal
5BT3					CT603385	Racal
5BT4					CT603362	Racal
5BT5					CT603362	Racal
5BT6					CT603387	Racal
5BT7					CT603387	Racal
5BT8					DT603386	Racal
5BT9					CT603387	Racal
6BT10					CT603387	Racal
5BT11					CT603362	Racal
5BT12					CT603362	Racal
5BT13					DT603385	Racal
5BT14					CT603362	Racal
5BT15					CT603362	Racal
<u>Miscellaneous</u>						
5BFB1		Ferrite Bead			907488	Mullard FX1242
5BFB2		Ferrite Bead			907488	Mullard FX1242
5BFB3		Ferrite Bead			907488	Mullard FX1242
5BFB4		Ferrite Bead			907488	Mullard FX1242

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
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VSWR BOARD PS316

Resistors (ohms)

R1	22	Fixed		2	911627	Electrosil TR5
R2	22	Fixed		2	911627	Electrosil TR5
R3	10k	Metal Oxide		5	900986	Electrosil TR4
R4	22k	Metal Oxide		5	908269	Electrosil TR4
R5	2.7k	Metal Oxide		5	908294	Electrosil TR4
R6	15k	Metal Oxide		5	908280	Electrosil TR4

Capacitors (uF)

C1	0.01	Fixed	25V	+50 -20	911845	Erie 831/T
C2	0.01	Fixed	25V	+50 -20	911845	Erie 831/T
C3	4-60pF	Dielectric Trimmer	200V	+50 -25	916940	Mullard 809-07011
C4	0.01	Fixed	25V	+50 -20	911845	Erie 831/T
C5	270pF	Silver Mica	125V	2	920435	Lemco M5119MR
C6	0.1	Fixed	100V	20	914173	ITT PMC2R
C7	0.01	Fixed	25V	+50 -20	911845	Erie 831/T
C8	0.01	Fixed	25V	+50 -20	911845	Erie 831/T
C9	47pF	Fixed	500V	10	917418	Erie 831/T

Diodes

D1	1N4149	914898	STC
D2	1N4149	914898	STC
D3	1N4149	914898	STC
D4	1N4149	914898	STC
D5	1N4149	914898	STC
D6	1N4149	914898	STC

Cct. Ref.	Value	Description	Rot.	Tol. %	Rocal Port Number	Manufacturer
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PROTECTION BOARD PS251

Resistors (ohms)

5CR1	1k	Pre-set Linear			919805	Plessey MPWT (Dealer)
5CR2	2.2k	Metol Oxide		5	908270	Electrosil TR4
5CR3	2.2k	Metol Oxide		5	908270	Electrosil TR4
5CR4	4.7k	Metal Oxide		5	900989	Electrosil TR4
5CR5	1k	Metal Oxide		5	908267	Electrosil TR4
5CR6	2.2k	Metol Oxide		5	908270	Electrosil TR4
5CR7	68k	Metol Oxide		5	908279	Electrosil TR4
5CR8	27k	Metol Oxide		5	908295	Electrosil TR4
5CR9	1k	Metol Oxide		5	908267	Electrosil TR4
5CR10	68	Metal Oxide		5	908278	Electrosil TR4
5CR11	220	Metol Oxide		5	900988	Electrosil TR4
5CR12	220	Metol Oxide		5	900988	Electrosil TR4
5CR13	1k	Metol Oxide		5	917265	Electrosil TR4
5CR14	100	Metol Oxide		5	908276	Electrosil TR6
5CR15	Not Used					
5CR16	680	Metal Oxide		5	908390	Electrosil TR4
5CR17	10k	Metol Oxide		5	900986	Electrosil TR4
5CR18	330	Metol Oxide		5	908268	Electrosil TR4
5CR19	6.8k	Metol Oxide		5	900987	Electrosil TR4
5CR20	100	Metal Oxide		5	908276	Electrosil TR4
5CR21	Not Used					
5CR22	27	Metol Oxide		2	911628	Electrosil TR5
5CR23	330	Metol Oxide		5	908268	Electrosil TR4
5CR24	27	Metol Oxide		2	911628	Electrosil TR5
5CR25	120k	Metol Oxide		5	908281	Electrosil TR4
5CR26	2.2k	Metol Oxide		5	908270	Electrosil TR4

Copocitors (uF)

5CC1	3300pF	Fixed	500V	25	917437	Erie 831/K7004
5CC2	0.1	Fixed	100V	20	914173	ITT PMC2R
5CC3	1	Fixed	100V	20	919311	ITT PMC2R
5CC4	0.1	Fixed	100V	20	914173	ITT PMC2R
5CC5	1000pF	Ceromicon	500V	20	915243	Erie HI-K831

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
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PROTECTION BOARD (Continued)

Capacitors (uF) (contd.)

5CC6	1000pF	Ceramicon	500V	20	915243	Erie HI-KB31
5CC7	0.1	Fixed	100V	20	914173	ITT PMC2R

Transistors

5CTR1	BC107				911929	Mullard
5CTR2	BC107				911929	Mullard
5CTR3	BCY71				91192B	Mullard
5CTR4	BCY71				91192B	Mullard
5CTR5	BCY71				911928	Mullard
5CTR6	BFY51				90B753	Mullard
5CTR7	BFY51				90B753	Mullard

Diodes

5CD1	8ZY88C5V6				912747	Mullord
5CD2	BZY88C5V6				912747	Mullord
5CD3	8ZY88C5V6				912747	Mullord
5CD4	BZY88C5V6				912747	Mullord
5CD5	BZY88C15				919797	Mullord
5CD6	1N4149				914898	STC
5CD7	1N4149				914898	STC
5CD8	1N4002				911460	Texas

STABILIZER MODULE MS440

Resistors (ohms)

4R1	0.05	Wirewound		10	920181	CGS, HSA50
4R2	100	Metal Oxide		5	90B276	Electrosil TR4
4R3	100	Metal Oxide		5	90B276	Electrosil TR4
4R4	680	Metal Oxide		5	90B390	Electrasil TR4
4R5	0.1	Wirewound		10	920407	CGS, HSA25
4R6	0.1	Wirewound		10	920407	CGS, HSA25
4R7	0.05	Wirewound		5	921606	CGS, HSA5
4R8	0.05	Wirewound		5	921606	CGS, HSA5
4R9	0.2	Wirewound		5	92041B	CGS, HSA5
4R10	2.7	Wirewound		5	9201B4	CGS, HSA50

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
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STABILIZER MODULE (Continued)

Resistors (ohms) (contd.)

4R11	680	Metal Oxide		5	908390	Electrosil TR4
4R12	100	Metal Oxide		5	908276	Electrosil TR4
4R13	56	Metal Oxide		5	908142	Electrosil TR5

Capacitors (uF)

4C1	Not Used					
4C2	0.1	Fixed	250V	20	919807	ITT PMC2R
4C3	68	Electrolytic	63V		919121	Mullard 108-18689
4C4	0.1	Fixed	250V	20	919807	ITT PMC2R

Diodes

4D1		1N4002			911460	Texas
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Transistors

4TR1		2N3055			915654	Mullord
4TR2		BSW66			917389	Mullord
4TR3		2N3055			915654	Mullord
4TR4		2N3055			915654	Mullord
4TR5		8FY51			908753	Mullord
4TR6		8FY51			908753	Mullord
4TR7		2N3055			915654	Mullard

STABILIZER P.C.8. PS313

Resistors (ohms)

4AR1	10k	Metal Oxide		5	900986	Electrosil TR4
4AR2	1k	Metal Oxide		5	908267	Electrosil TR4
4AR3	100	Variable			920531	Plessey MPWT (Dealer)
4AR4	150	Metal Oxide		5	909121	Electrosil TR4
4AR5	1k	Metal Oxide		5	908267	Electrosil TR4
4AR6	10k	Metal Oxide		5	900986	Electrosil TR4
4AR7	100	Metal Oxide		5	908276	Electrosil TR4
4AR8	1k	Wirewound	2½W	5	913626	Welwyn W21
4AR9	2.2k	Metal Oxide		5	908270	Electrosil TR4
4AR10	470	Variable			920058	Plessey MPWT (Dealer)

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>STABILIZER P.C. Board (Continued)</u>						
<u>Resistors (ohms) (Contd.)</u>						
4AR11	470	Metal Oxide		5	900992	Electrasil TR4
4AR12	1.2k	Metal Oxide		2	906550	Electrasil TR5
4AR13	1k	Metal Oxide		5	908267	Electrasil TR4
4AR14	680	Metal Oxide		5	908390	Electrasil TR4
4AR15	560	Metal Oxide		5	909841	Electrasil TR4
4AR16	100	Variable			920531	Plessey MPWT (Dealer)
4AR17	220	Metal Oxide		5	900988	Electrasil TR4
4AR18	3.3k	Metal Oxide		5	900991	Electrasil TR4
<u>Capacitors (uF)</u>						
4AC1	0.1	Fixed	250V	20	919807	ITT PMC2R
4AC2	0.1	Fixed	250V	20	919807	ITT PMC2R
4AC3	33	Electrolytic	63V		920534	Mullard 108-18339
4AC4	0.01	Fixed		20	920533	ITT PMC2R
4AC5	0.1	Fixed	250V	20	919807	ITT PMC2R
4AC6	0.1	Fixed	250V	20	919807	ITT PMC2R
4AC7	0.01	Fixed		20	920533	ITT PMC2R
4AC8	0.1	Fixed	250V	20	919807	ITT PMC2R
<u>Diodes</u>						
4AD1		1N4002			911460	Texas
4AD2		1N4002			911460	Texas
4AD3		6ZY88C5V6			912747	Mullard
4AD4		BZY88C5V6			912747	Mullard
<u>Transistors</u>						
4ATR1		BSV68			915267	Mullard
4ATR2		BSW66			917389	Mullard
4ATR3		8CY71			911928	Mullard
4ATR4		8FY51			908753	Mullard

Cct. Ref.	Value	Description	Rat.	Tol. %	RocalPart Number	Manufacturer
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COMBINING UNIT 500W MS126 (and P.C. Baard PS122)

Resistors (ohms)

6R1	180	Metal Oxide		5	909125	Electrosil TR4
6R2	180	Metal Oxide		5	909125	Electrosil TR4
6R3	100	High Power		5	919969	Electrosil H37
6R4	100	High Power		5	919969	Electrosil H37
6R5	200	High Power		5	921588	Electrosil H37
6R6	200	High Power		5	921588	Electrosil H37
6R7	10	Metal Oxide		5	908471	Electrosil TR5
6R8	10	Metal Oxide		5	908471	Electrosil TR5
6R9	10	Metal Oxide		5	908471	Electrosil TR5

Capacitors (uF)

6C1	0.1	Fixed	100V	20	914173	ITT PMC2R/0.1/M100
6C2	0.1	Fixed	100V	20	914173	ITT PMC2R/0.1/M100
6C3	68pF	Fixed		10	920176	LCC CA1
6C4	Not Used					
6C5	100pF	Fixed		10	920177	LCC AAU020
6C6	0.1	Fixed			914173	ITT PMC2R/0.1/M100

Diodes

6D1	1N4149				914898	STC
6D2	1N4149				914898	STC

Inductors

6L1					CT603079	Racal
6L2					CT603079	Racal
6L3					CT603080	Racal
6L4	Choke				922364	Cambion 550-3640-45-02

Transformers

6T1					BT603141	Racal
6T2					BT603141	Racal
6T3					DT602946	Racal
6T4					DT602946	Racal
6T5					DT602946	Racal

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>COMBINING UNIT (Continued)</u>						
<u>Transformers (contd.)</u>						
6T6					DT602946	Racal
6T7					BT603701	Racal
6T8					BT603701	Racal
6T9					BT603066	Racal
6T10					BT603066	Racal
6T11					CT602989	Racal
6T12					BT603701	Racal
6T13					BT603066	Racal
<u>Connectors</u>						
6SK 1		BNC, 50 ohms			900061	Transradio 5935-99-911-8079
6SK 2		BNC, 50 ohms			900061	Transradia 5935-99-911-8079
6SK 3		BNC, 50 ohms			900061	Transradia 5935-99-911-8079
6SK 4		BNC, 50 ohms			900061	Transradia 5935-99-911-8079
6SK 5		Receptacle Sub-assembly			AA602978	Racal
6SK 6		Receptacle Sub-assembly			AA602978	Racal
6SK 7		Receptacle Sub-Assembly			AA602978	Racal
6SK 8		BNC, 50 ohms			900061	Transradia 5935-99-911-8079
6SK 9		BNC, 50 ohms			900061	Transradio 5935-99-911-8079
6SK 10		BNC, 50 ohms			900061	Transradio 5935-99-911-8079
6PL 1		Printed Circuit Connector			915643	Cannon DE9P
6PL 2		Right Angle Plug (50 ohms)			908713	Amphenol AMP82
6PL 3		Right Angle Plug (50 ohms)			908713	Amphenol AMP82
6TS 1		Terminal Strip			905221	Wingrove & Rogers TS8-04

Cct. Ref.	Value	Description	Rot.	Tol. %	Racal Part Number	Manufacturer
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CONTROL PANEL MM377

Resistors (ohms)

2R1	150k	Fixed	$\frac{1}{4}$ W	10	902534	Marganite
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Diode

2D1		1N4002			911460	Texas
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Miscellaneous

2FS1		Fuselink 5A Size 0			906975	Belling Lee L693
2FS2		Fuselink 5A Size 0			906975	Belling Lee L693
		Fuseholder Size 0			900005	Belling Lee L1382
2LP1		Lamp, Neon			918753	Guest $1\frac{3}{4}$ NP5C/15/110
2RLA		Relay, Sealed, SP HD 12V 170 ohm			916469	ITT 4190EC
2RLB		Relay, 3 pole			921509	Arrow 128 A3U/100
2CB1		Circuit Breaker, 50/60Hz 10A 2 pole			921324	Highland Elect. APL-11-1-6-2-103
2CB2		Circuit Breaker, 50/60Hz 10A 2 pole			921324	Highland Elect. APL-11-1-6-2-103
2SA		Switch, Rotary 2way c/o and off 5A 250V			921590	Tok PS/110-7NSH
2P1		Plug 25 way Pattern 102			921508	Belling Lee L1328/ P/Ag

POWER SUPPLY MS64

The following list is compiled from Gresham Transformers Ltd., drawing number A43360A

Capacitors (uF)

Gresham Drawing No.

C1	10		250Va.c.	
C2	10,000	Electalytic		
C3	10,000	Electalytic	100V	A43360E-01
C4	10,000	Electolytic	100V	A43360E-01
C5	10,000	Electolytic	100V	A43360E-01

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
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POWER SUPPLY (Continued)

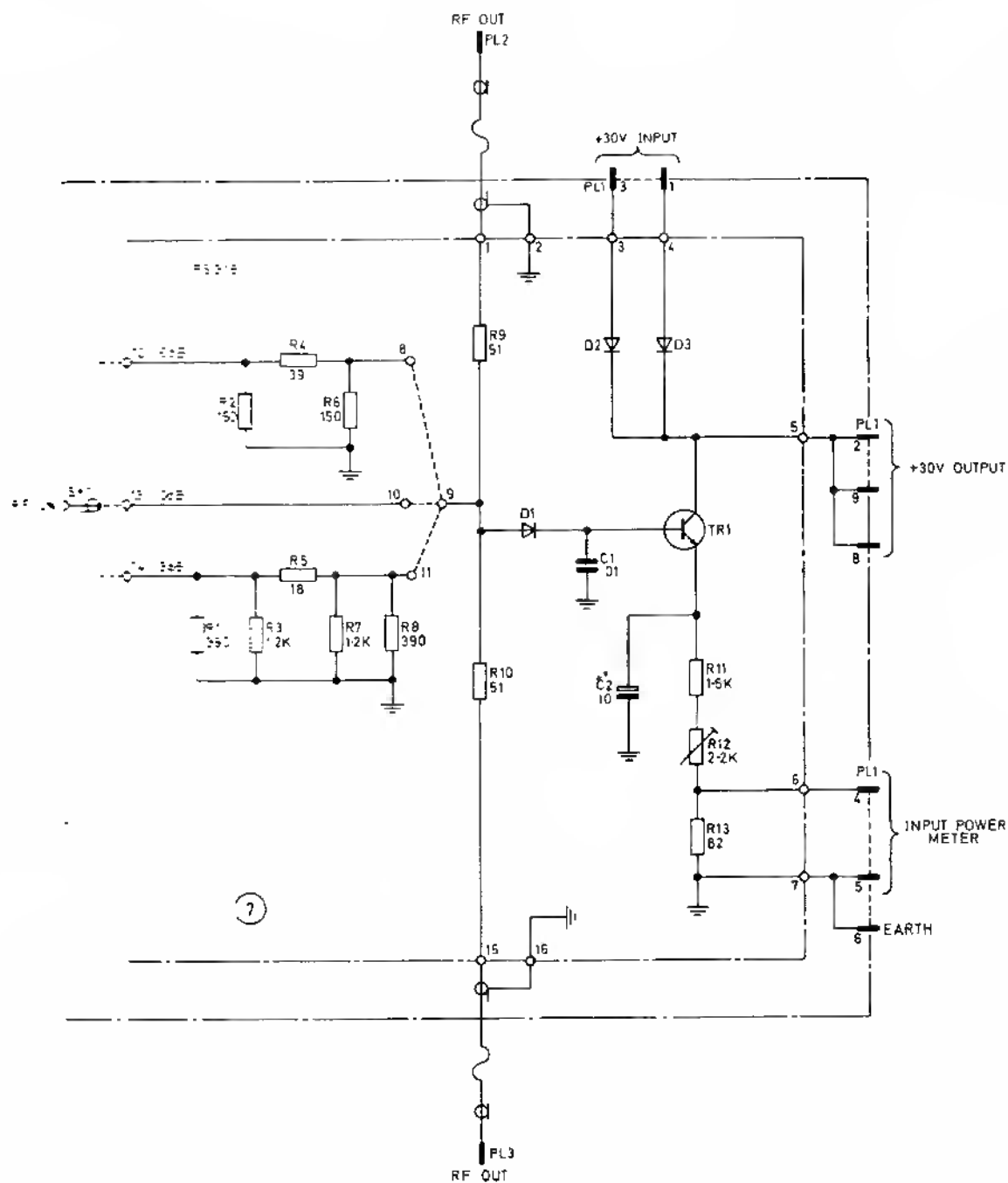
<u>Diodes</u>		<u>Gresham Drawing No.</u>
D1-D4	1R-25G10 (4 off)	A43360E-07
D5-D8	1R-BS1	
<u>Miscellaneous</u>		
T1	Mains Transformer	43365
L1	Choke, 5mH	43366
VS1	Mains Selector Unit	UE 60666L5-2

MUTING UNIT (MS565)

<u>Resistors (ohm)</u>						
12AR1	100	Fixed		5	913962	Electrosil TR6
12AR2	100	Fixed		5	913962	Electrosil TR6
12AR3	47	Wirewound		5	913695	Welwyn W22
12AR4	390	Metal Oxide		5	908472	Electrosil TR4
12AR5	150	Metal Oxide		5	909121	Electrosil TR4
12AR6	1.2k	Metal Oxide		5	908285	Electrosil TR4
12AR7	1k	Metal Oxide		5	908267	Electrosil TR4
12AR8	39	Metal Oxide		5	910491	Electrosil TR4
12AR9	18	Metal Oxide		5	916626	Electrosil TR4
12AR10	1.2k	Metal Oxide		5	908285	Electrosil TR4
12AR11	2.2k	Metal Oxide		5	908270	Electrosil TR4
12AR12	150	Metal Oxide		5	909121	Electrosil TR4
12AR13	390	Metal Oxide		5	908472	Electrosil TR4
12AR14	33	Wirewound		5	913584	Welwyn W21
12AR15	1k	Metal Oxide		5	908267	Electrosil TR4
12AR16	4.7k	Metal Oxide		5	900989	Electrosil TR4
12AR17	47k	Metal Oxide		5	908391	Electrosil TR4
12AR18	10k	Metal Oxide		5	900986	Electrosil TR4
12AR19	4.7k	Metal Oxide		5	900989	Electrosil TR4
12AR20	220	Metal Oxide		5	900988	Electrosil TR4
12AR21	470	Metal Oxide		5	906019	Electrosil TR5
12AR22	47k	Metal Oxide		5	908391	Electrosil TR4
12AR23	18k	Metal Oxide		5	916626	Electrosil TR4
12AR24	27k	Metal Oxide		5	908295	Electrosil TR4

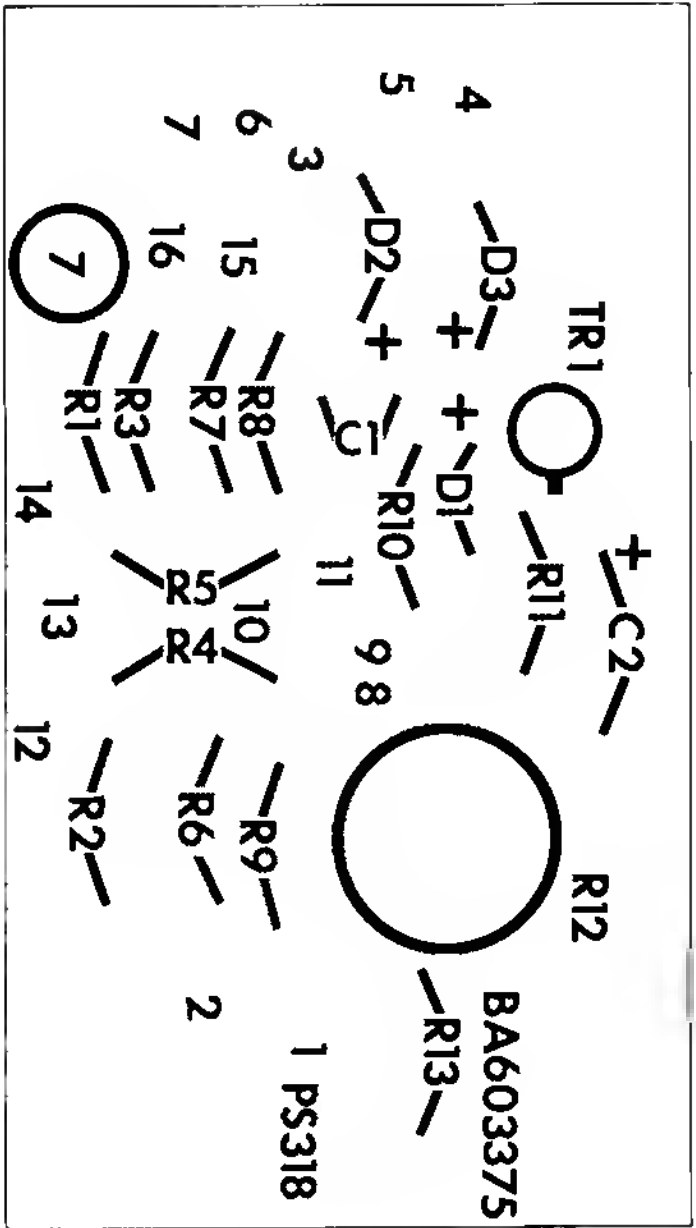
Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>MUTING UNIT (Continued)</u>						
<u>Capacitors (uF)</u>						
12AC1	0.1	Fixed	25V	+50 -25	911845	Erie 831/T
12AC2	0.1	Fixed	100V	20	914173	ITT, PMC2R
12AC3	0.1	Fixed	100V	20	914173	ITT, PMC2R
12AC4	0.1	Fixed	100V	20	914173	ITT, PMC2R
12AC5	0.1	Fixed	25V	+50 -25	911845	Erie, 831/T
12AC6	0.1	Fixed	100V	20	914173	ITT, PMC2R
12AC7	22	Electrolytic	63V	+50 -10	923636	Erie, 20101-100-OT
12AC8	10	Tantalum	20	20	905399	TAAB10M20
12AC9	0.1	Fixed	100V	20	914173	ITT, PMC2R
12AC10	0.1	Fixed	100V	20	914173	ITT, PMC2R
12AC11	0.1	Fixed	100V	20	914173	ITT, PMC2R
12AC12	39p	Fixed	500V	5	919459	Erie, 831/N750
<u>Diodes</u>						
12AD1		1N4002			923564	Fairchild
12AD2		1N4002			923564	Fairchild
12AD3		8ZY88C10			917217	Mullard
12AD4		1N4149			914898	STC
12AD5		1N4149			914898	STC
12AD6		1N4149			914898	STC
12AD7		1N4149			914898	STC
12AD8		1N4149			914898	STC
12AD9		1N4149			914898	STC
<u>Transistors</u>						
12ATR1		2N3553			916730	Mullard
12ATR2		2N3553			916730	Mullard
12ATR3		8FY51			908753	Mullard
12ATR4		8FY51			908753	Mullard
12ATR5		8FY51			908753	Mullard
12ATR6		BC107			911929	Mullard
12ATR7		BC107			911929	Mullard

Cct. Ref.	Value	Description	Rat.	Tol. %	Racal Part Number	Manufacturer
<u>MUTING UNIT (Continued)</u>						
<u>Transformers</u>						
12AT1		Output Transformer			CT604693	Racal
12AT2		Input Transformer			CT604693	Racal
<u>Ferrite Beads</u>						
12AFB1		FX1242			907488	Mullard
12AFB2		FX1242			907488	Mullard
12AFB3		FX1242			907488	Mullard
12AFB4		FX1242			907488	Mullard
<u>Connectors</u>						
12SK1		Coaxial 50 ohms			908387	Transradio BN5/5A
12SK2		Coaxial 50 ohms			908387	Transradio BN5/5A
12PL1		9-way plug			915643	Cannon DE9P

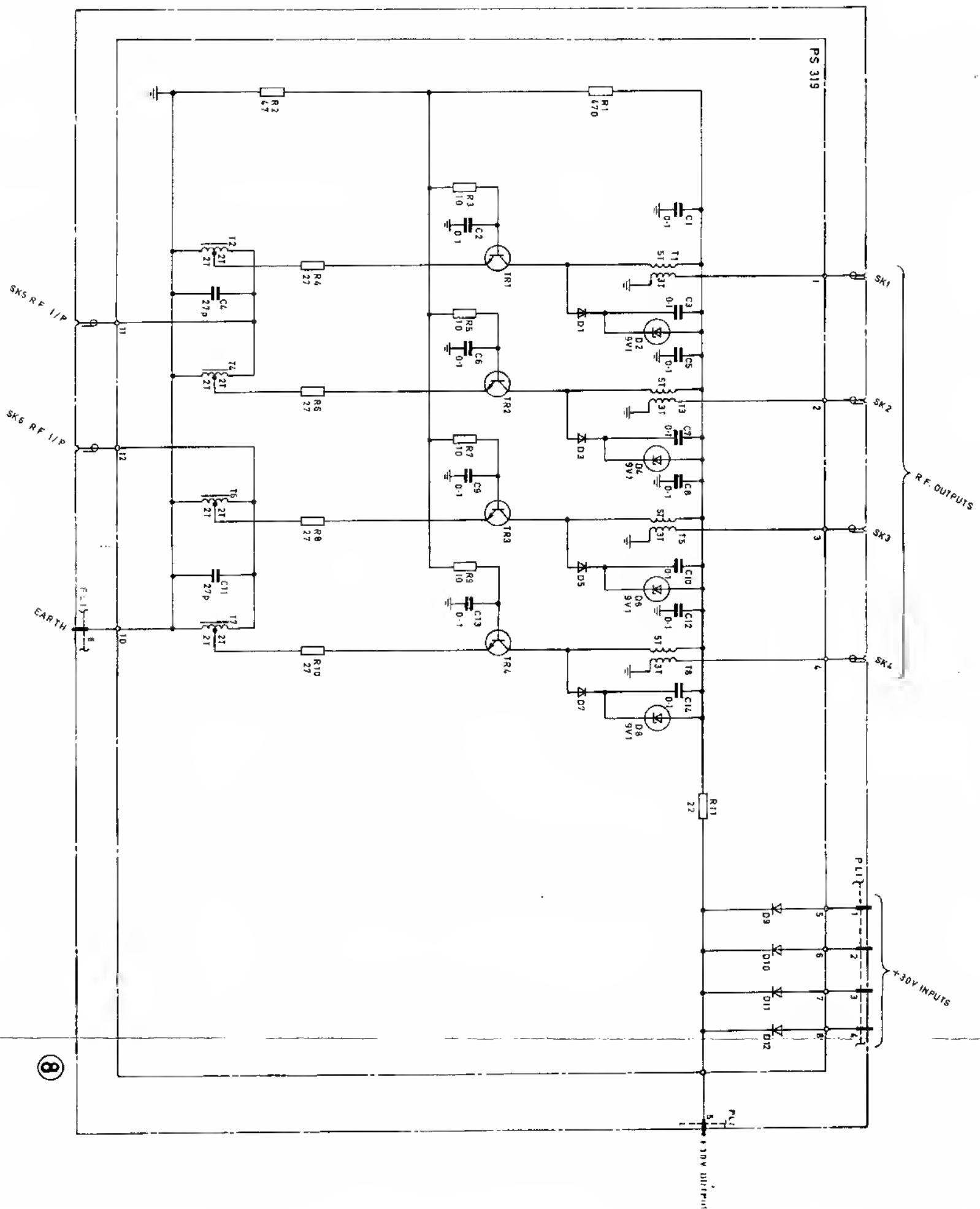


Circuit: Splitter Unit MS444

Fig. 1



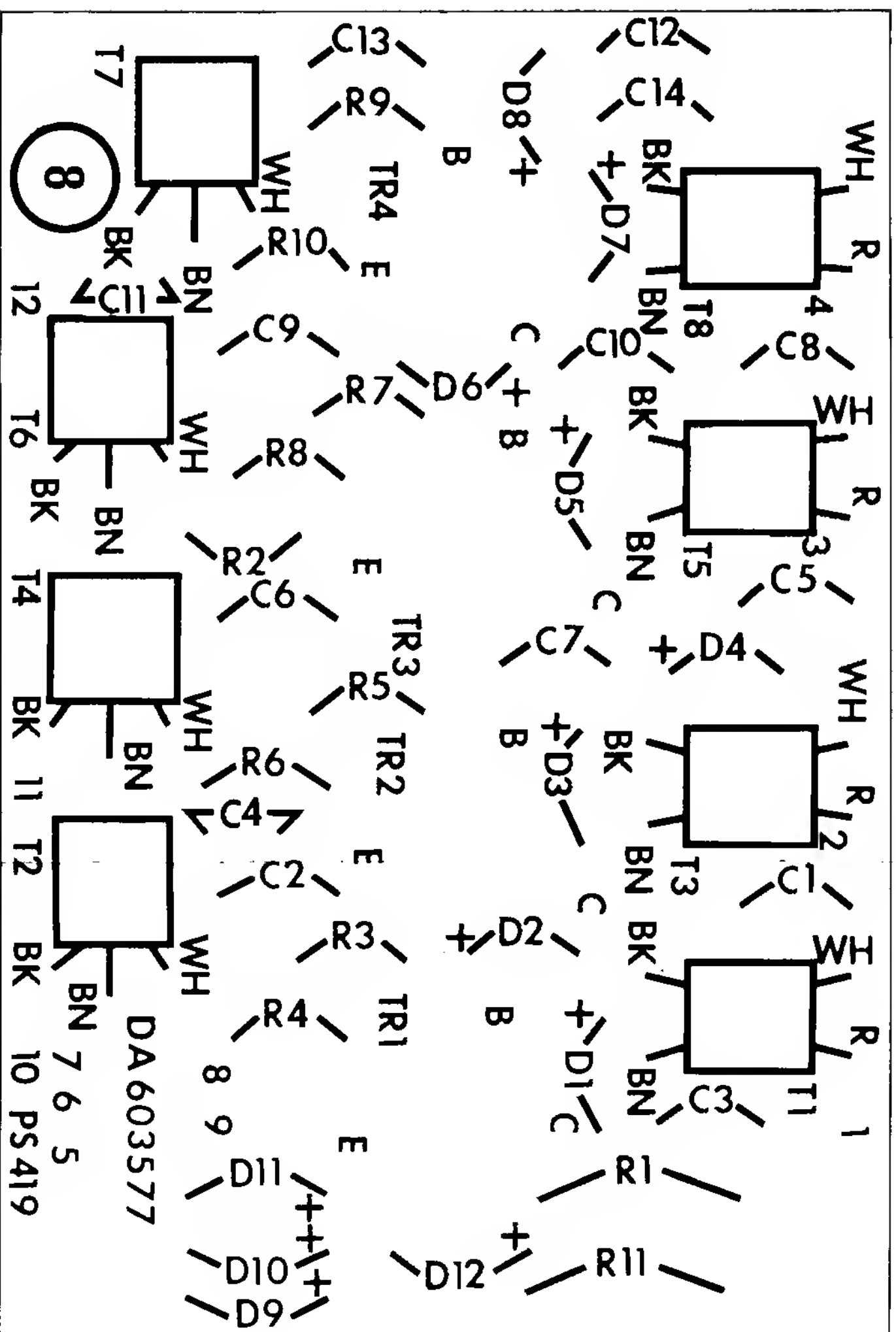
Component Layout: Splitter Unit PCB PS318 Fig 2



W041083 DC00339/B
A

Circuit: Distribution Amplifier MS 240

Fig. 3

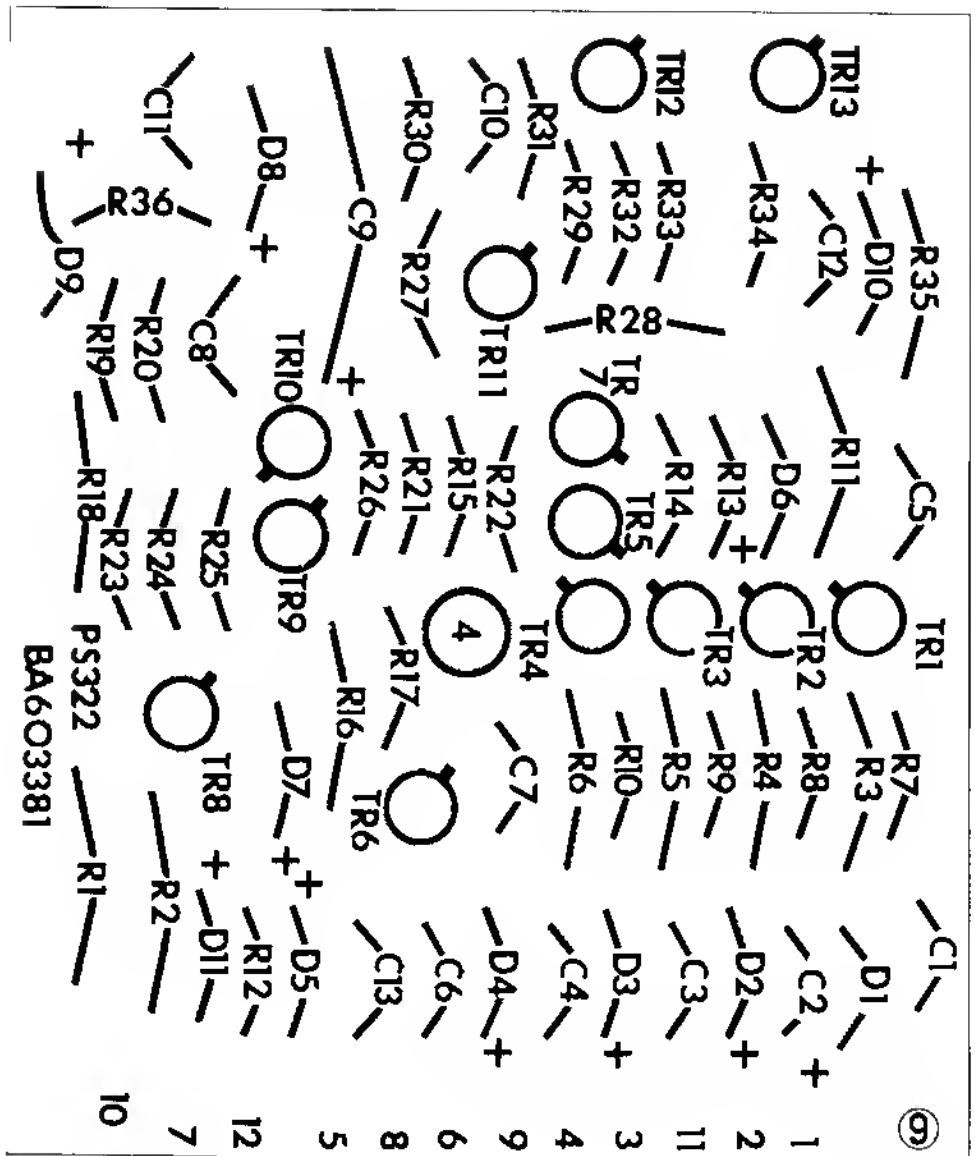


WOH4083

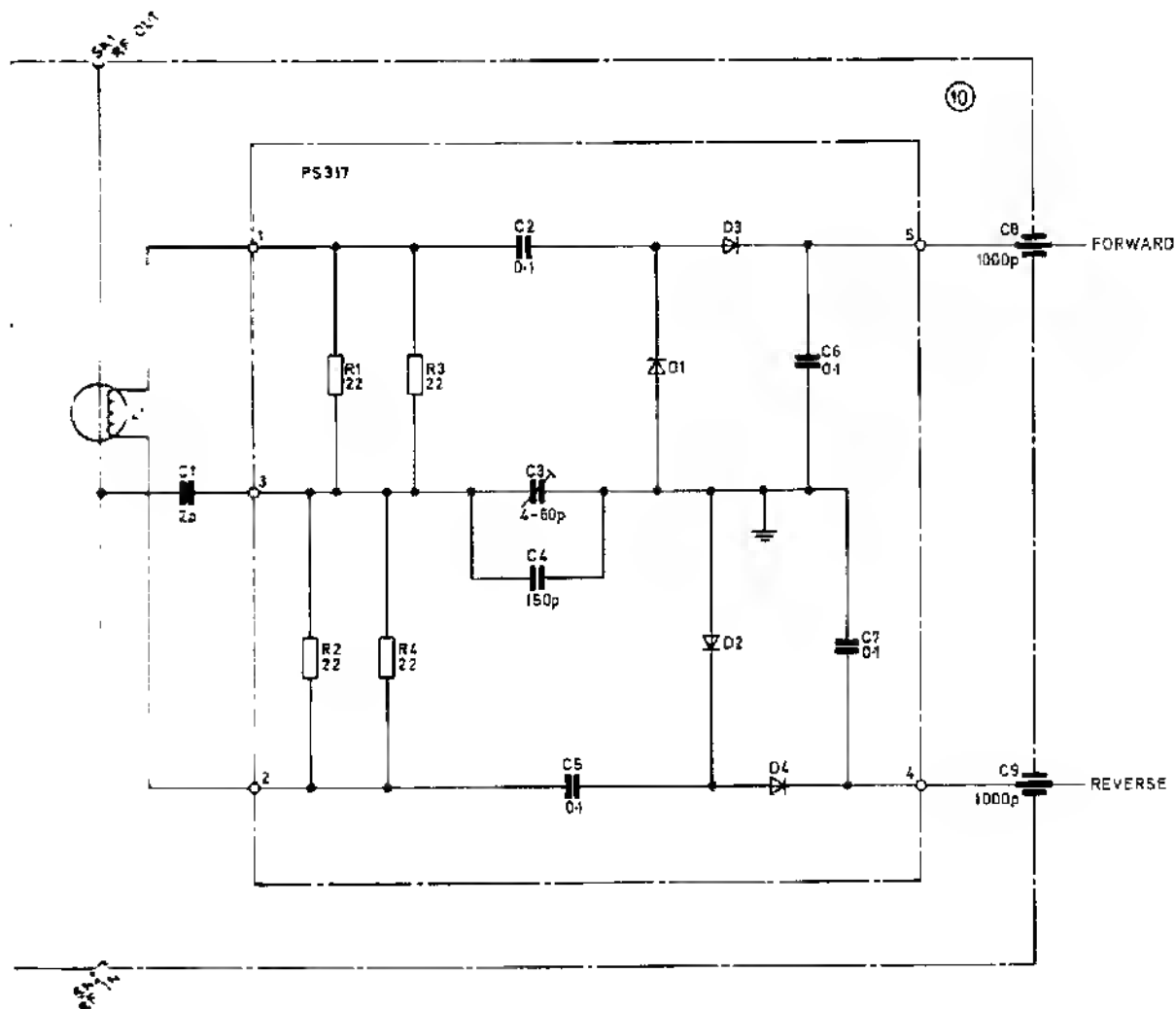
Component Layout: Distribution Amplifier PC.B. PS319

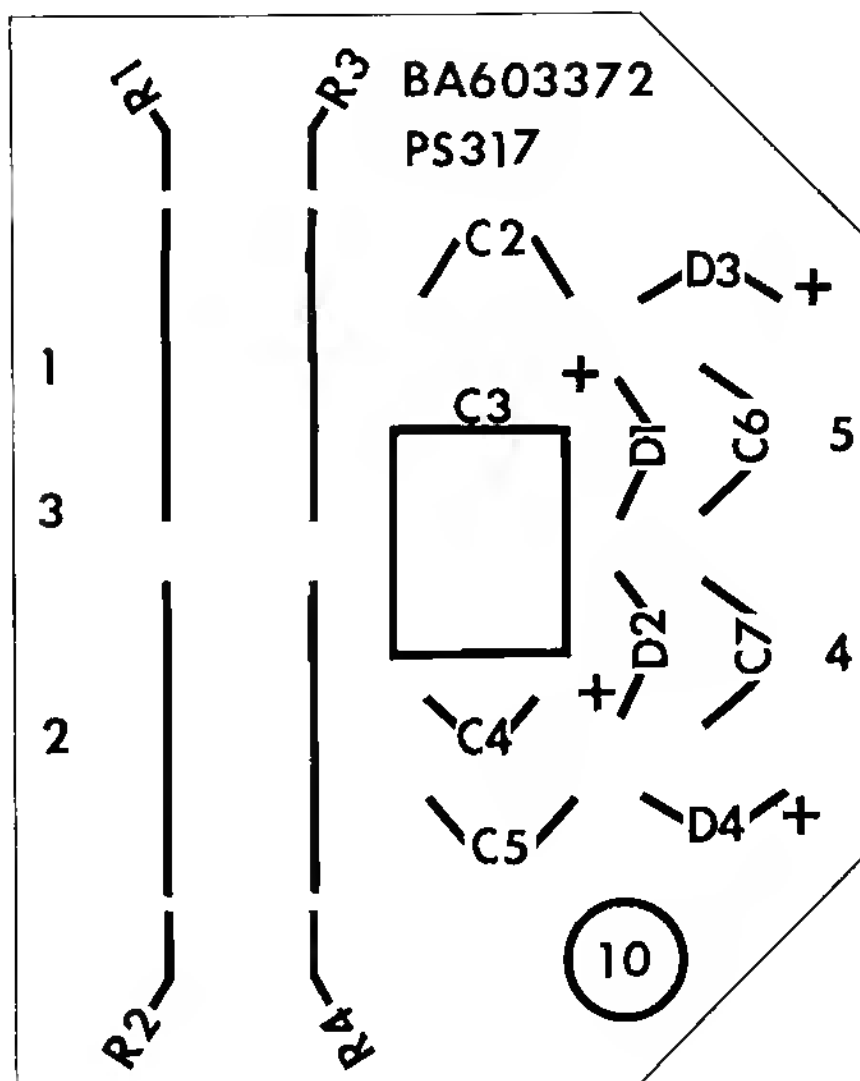


Fig. 5



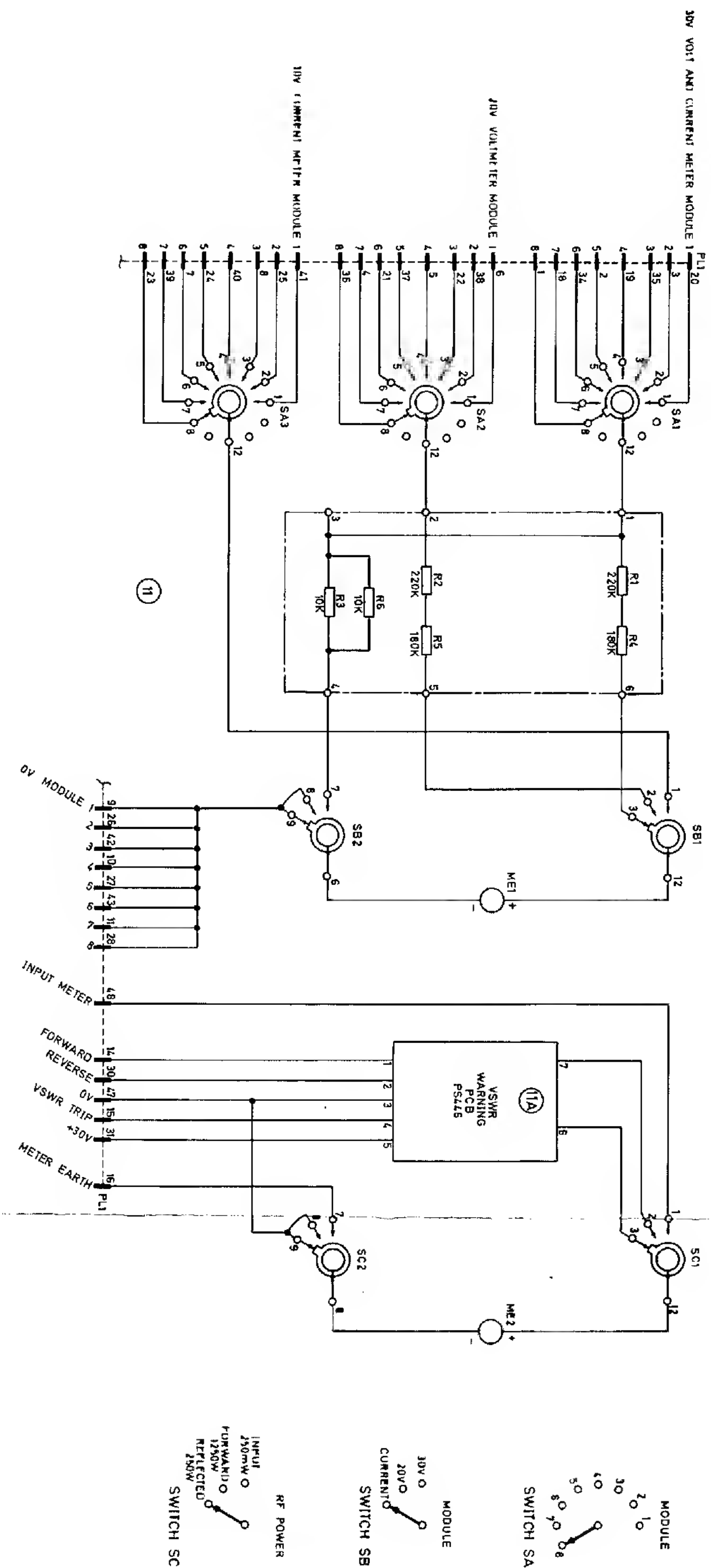
Component Layout : Overload Unit PCB PS322 Fig. 6





REV	BA 603372

Component Layout:
Cabinet V.S.W.R. Unit PCB PS317



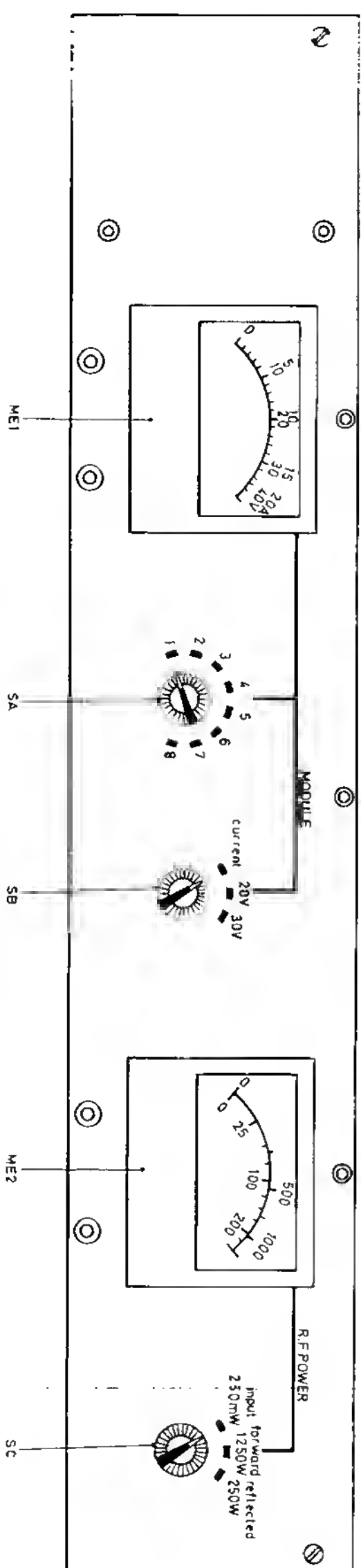
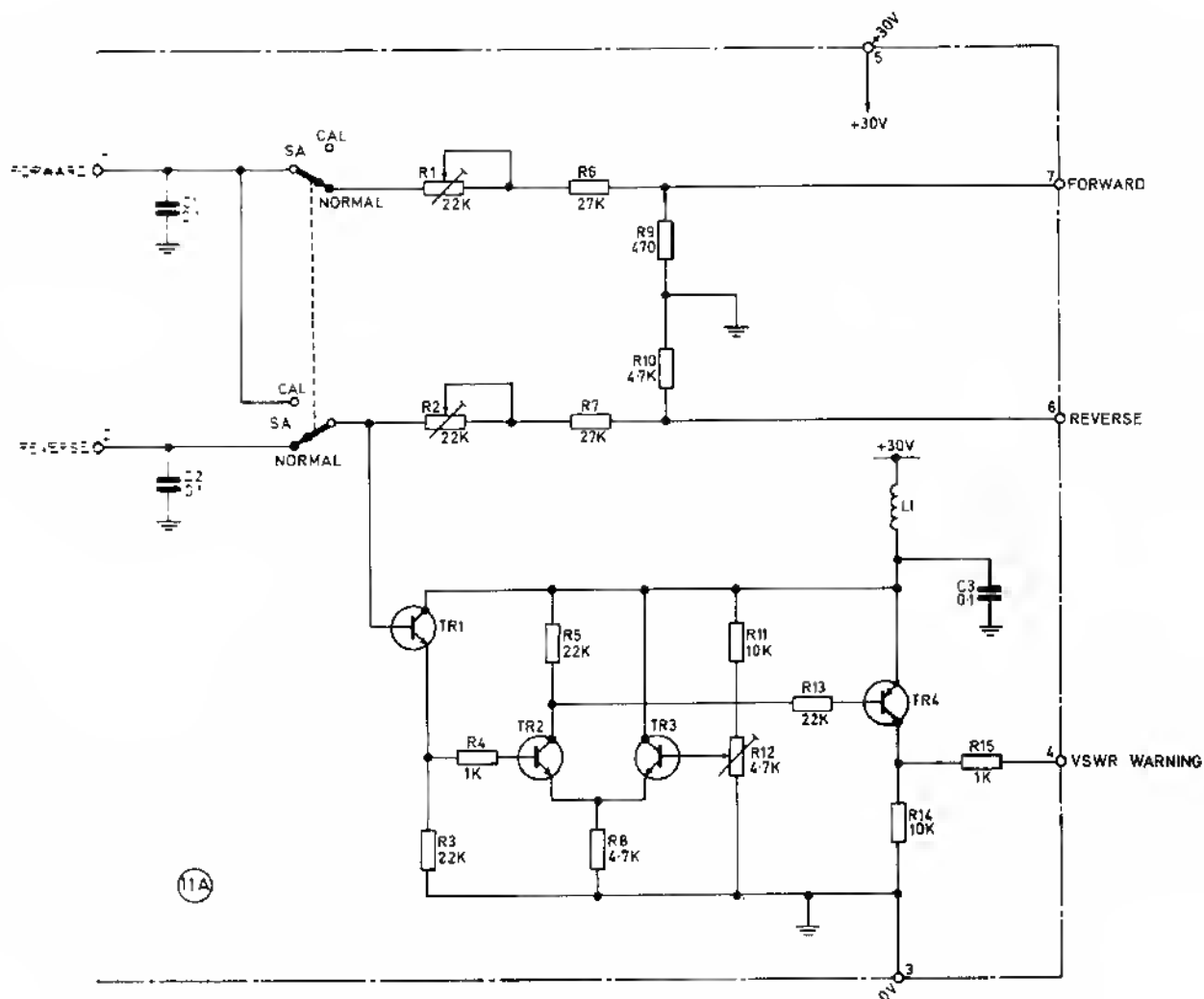
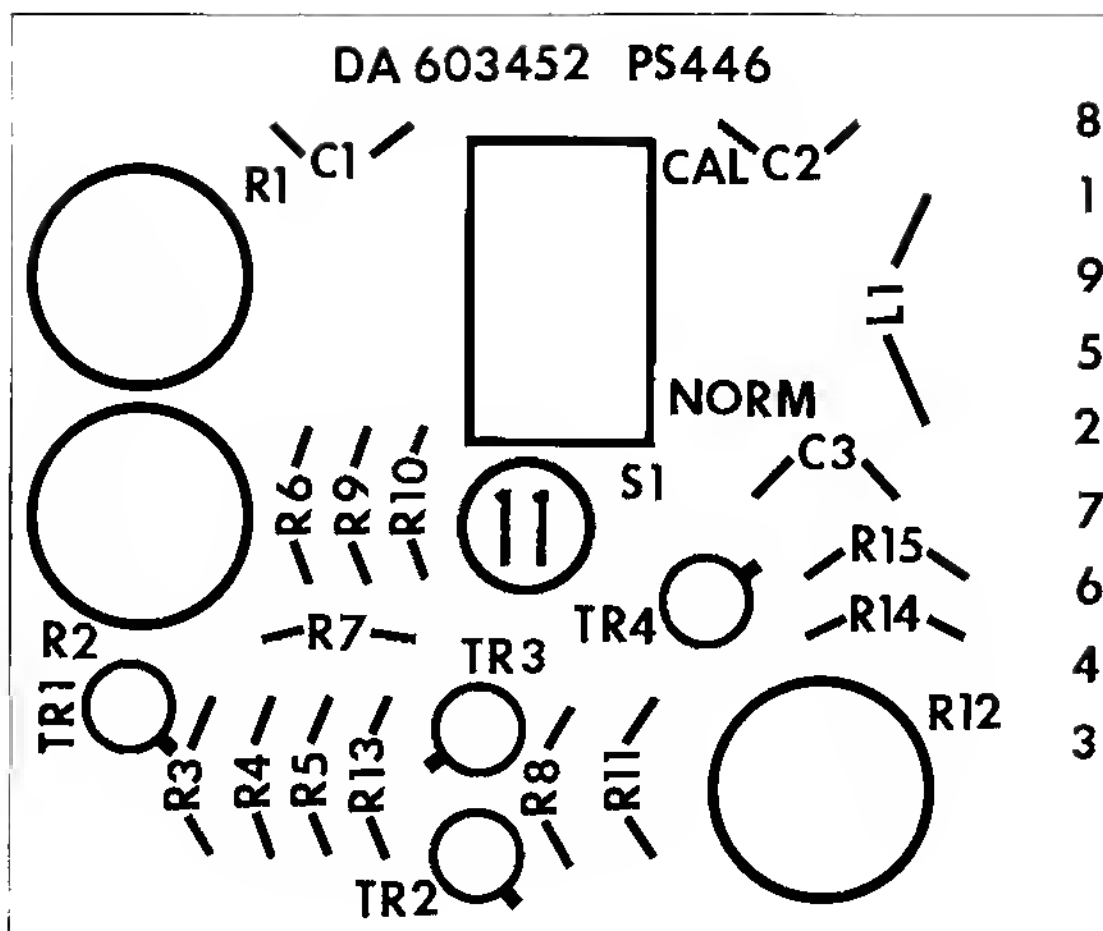
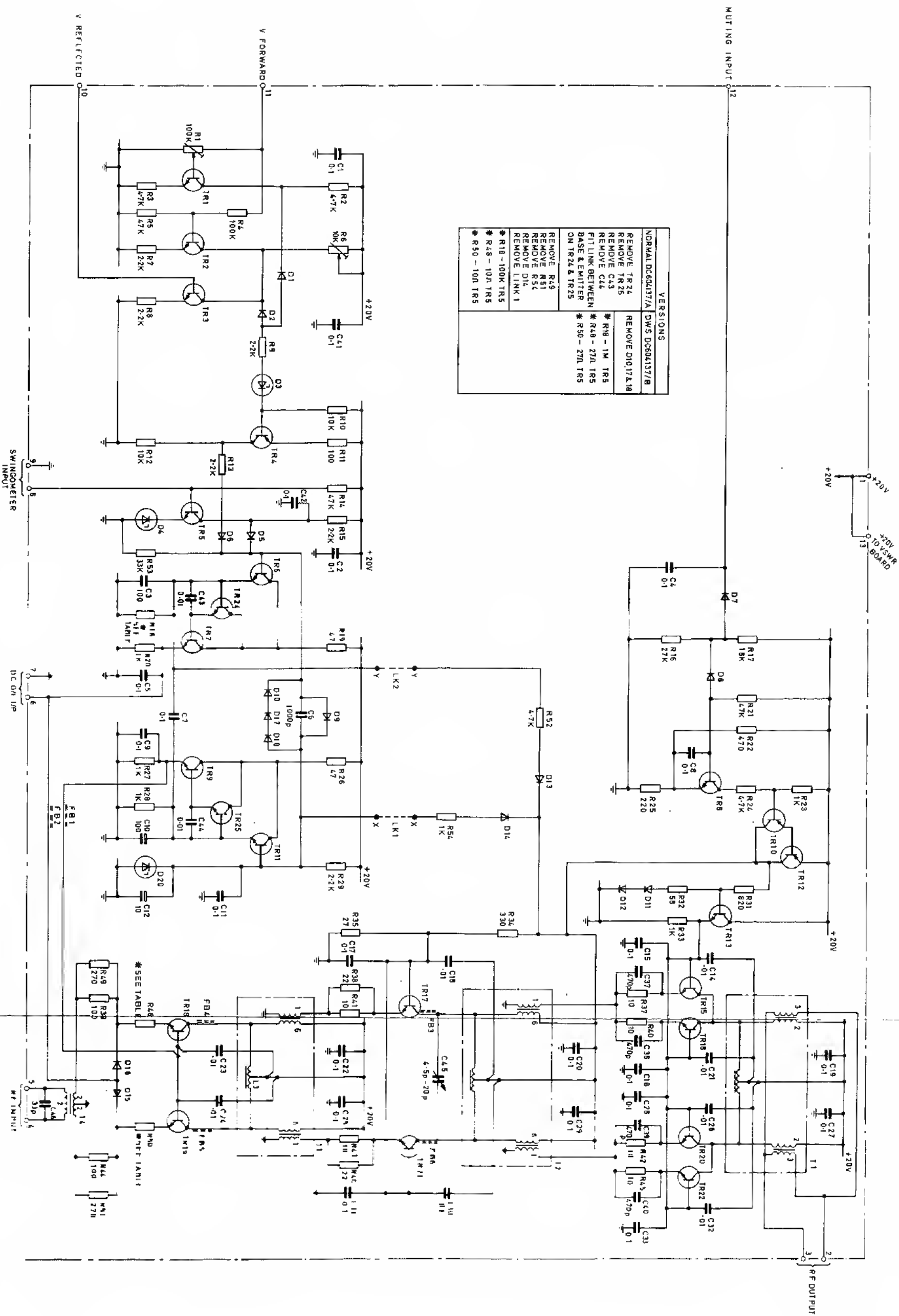


Fig. 10



(11A)





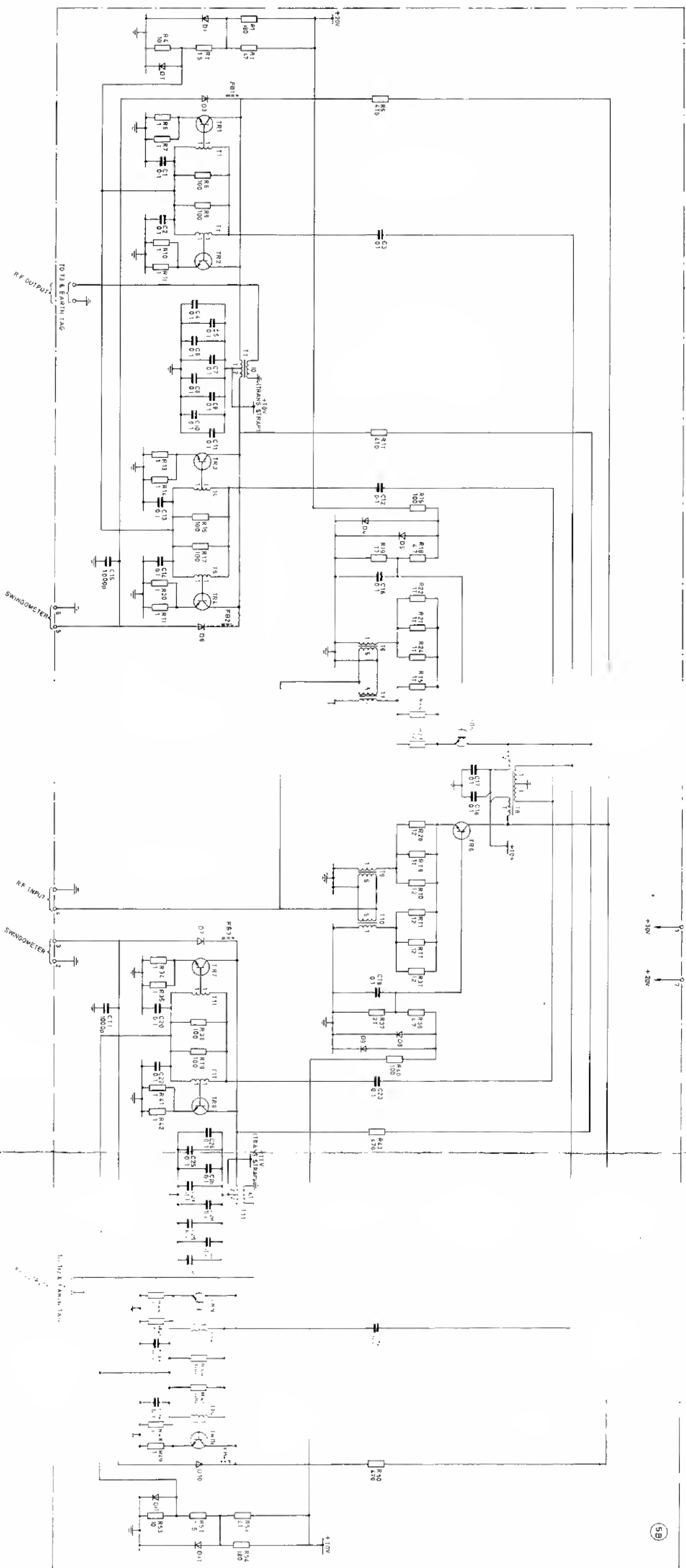
WON4083 DC60137
C

Circuit: Low Level P.C.B. PS351



Component Layout: Low Level P.C.B PS351

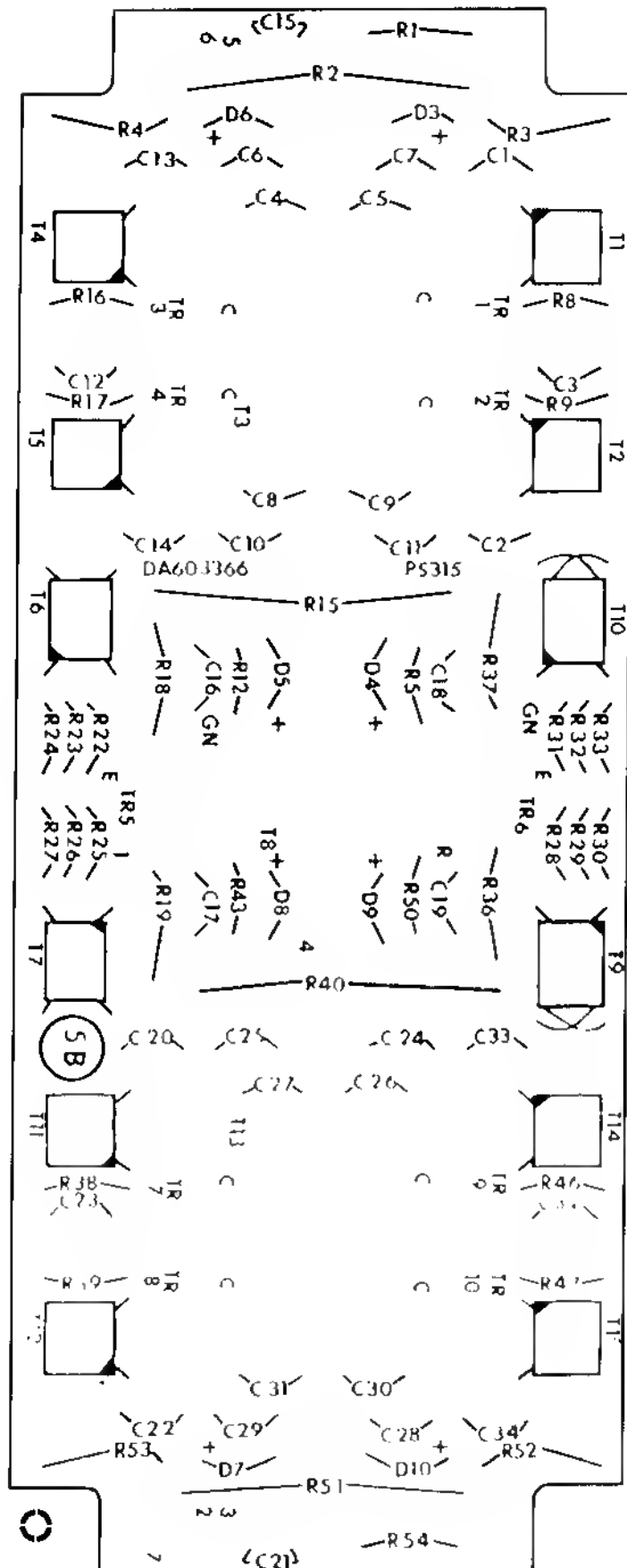
Fig. 14



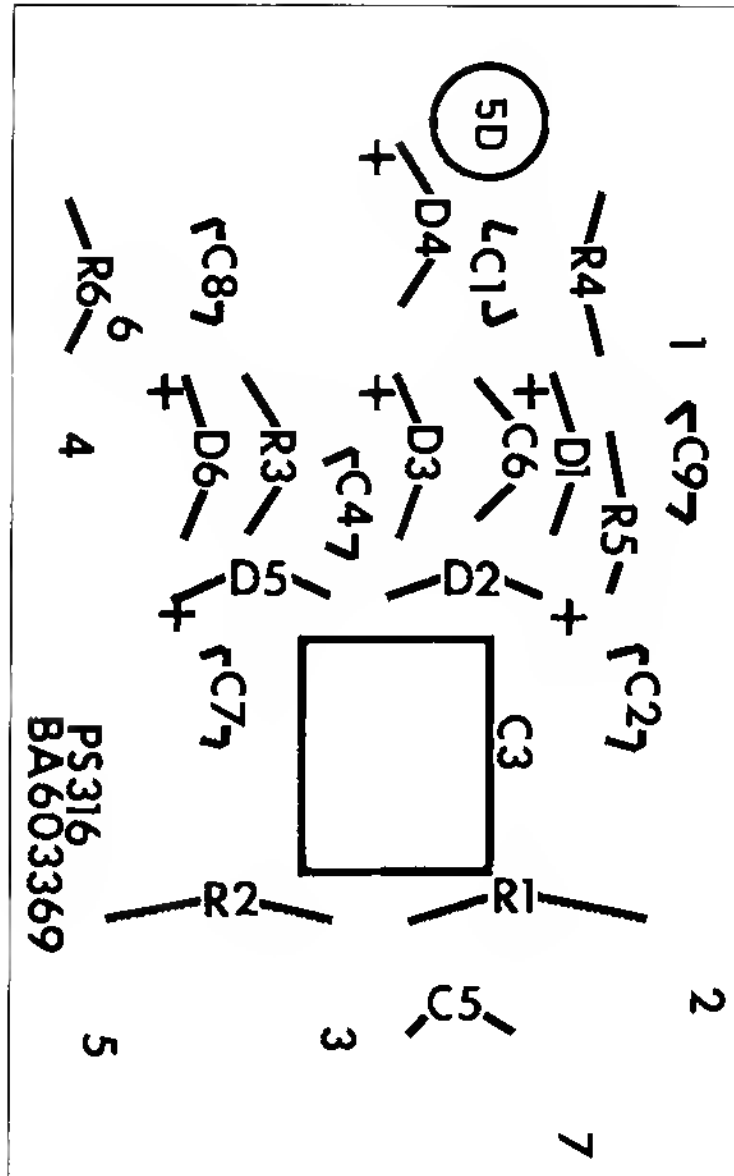
PS315-10.73 & 10.74 TAG

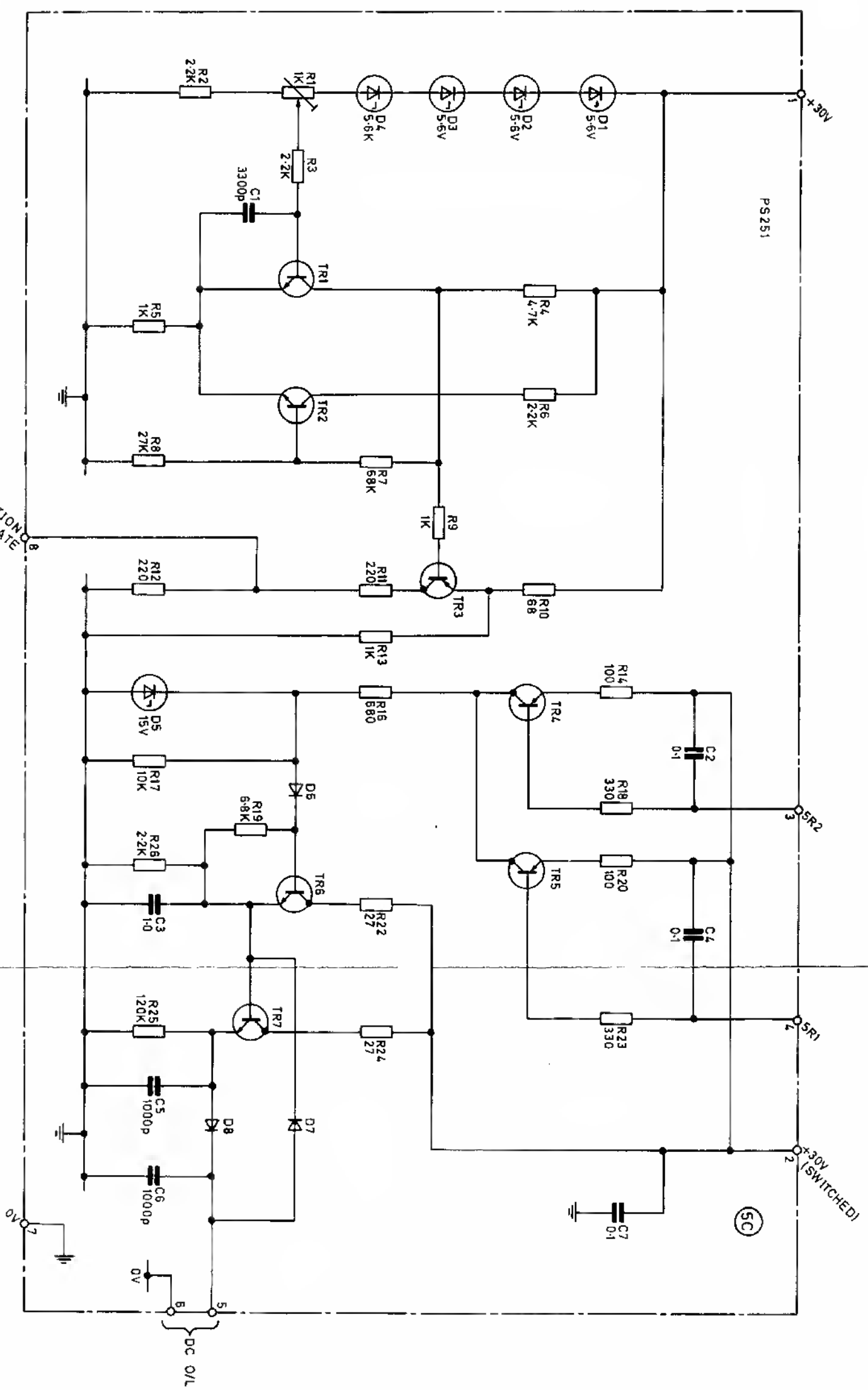
Circuit: High Level Board PS315

Fig.15





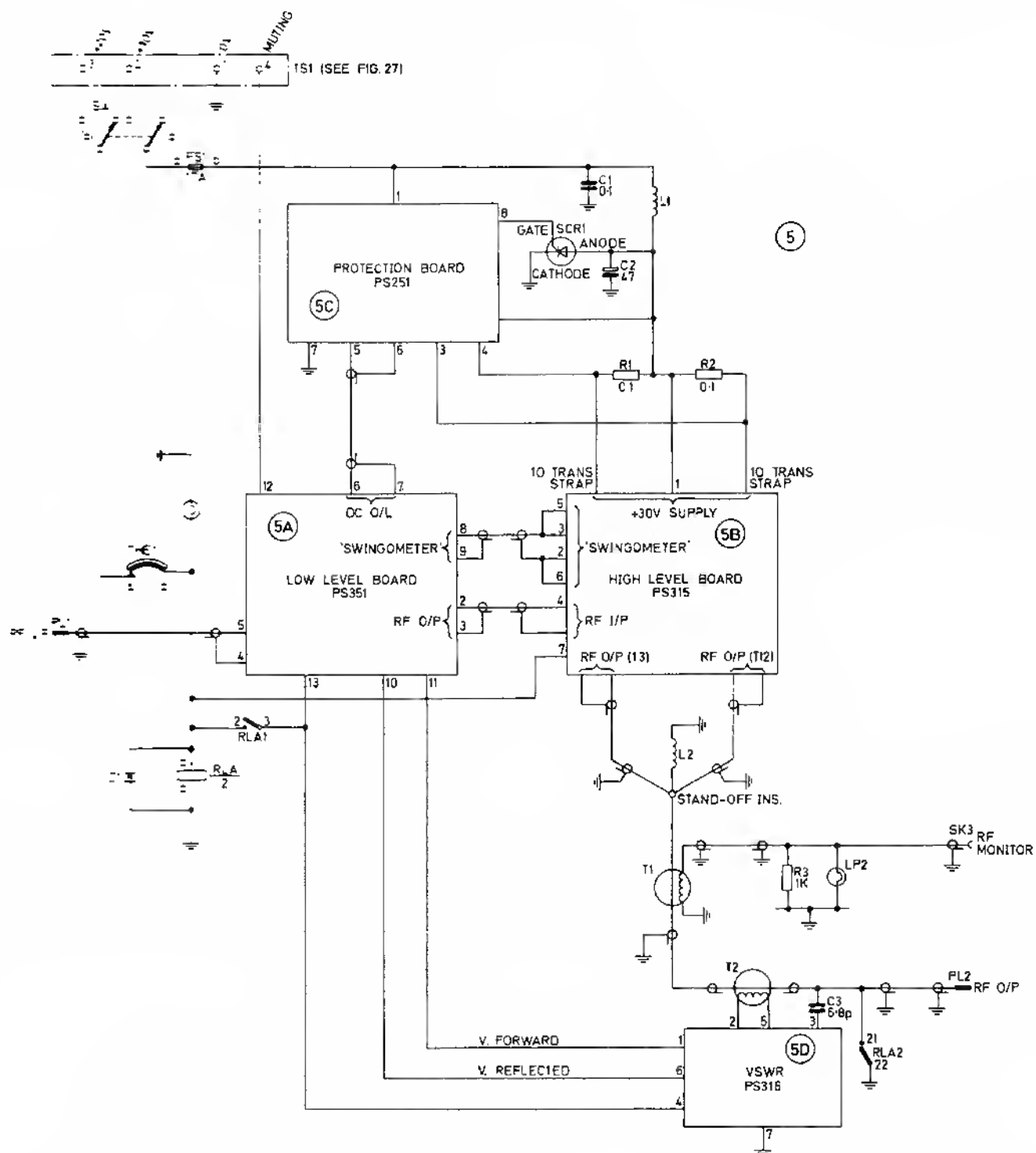




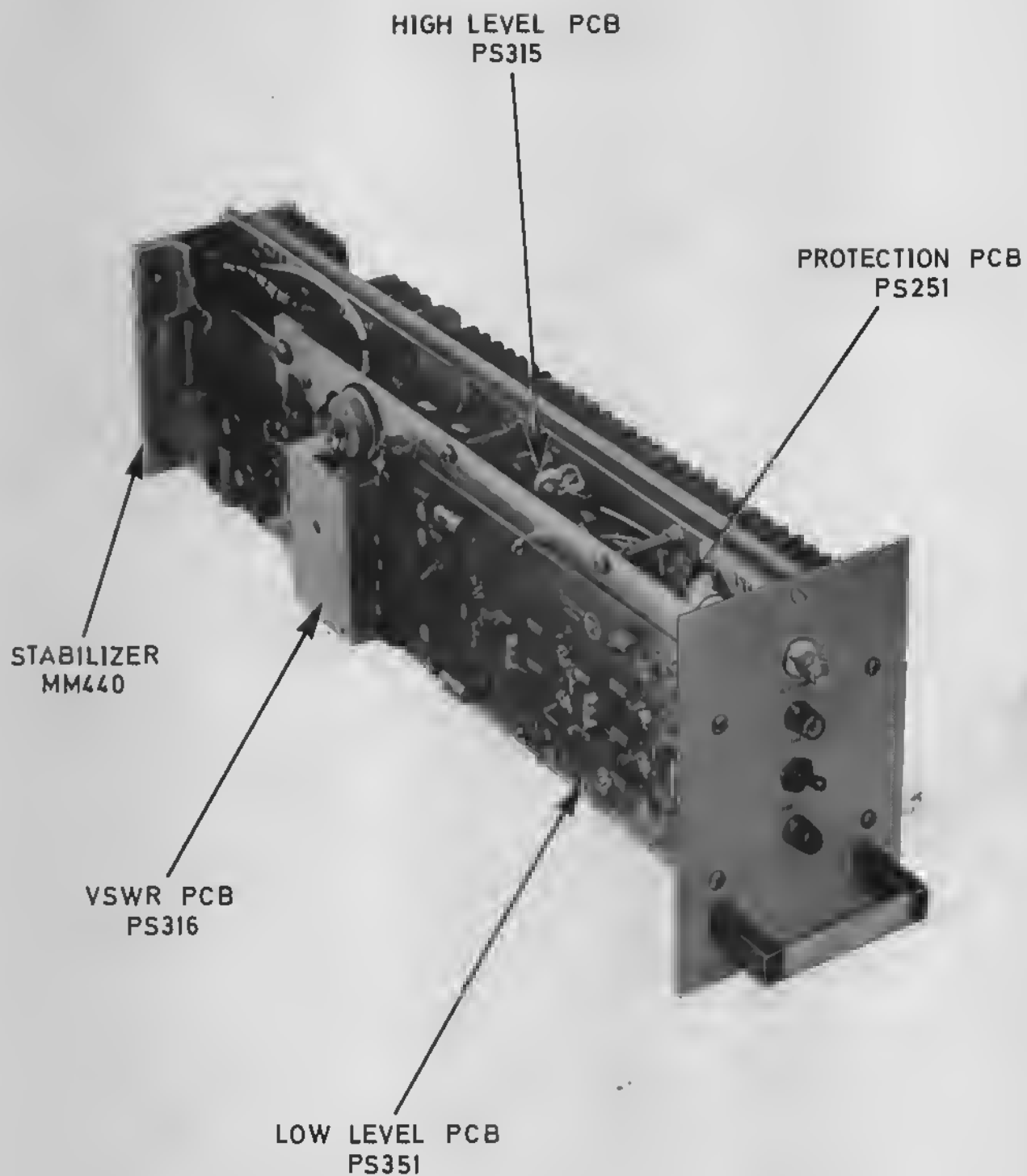
WOH 4083 DC603250
D

Circuit: Protection P.C.B PS251

Fig. 19



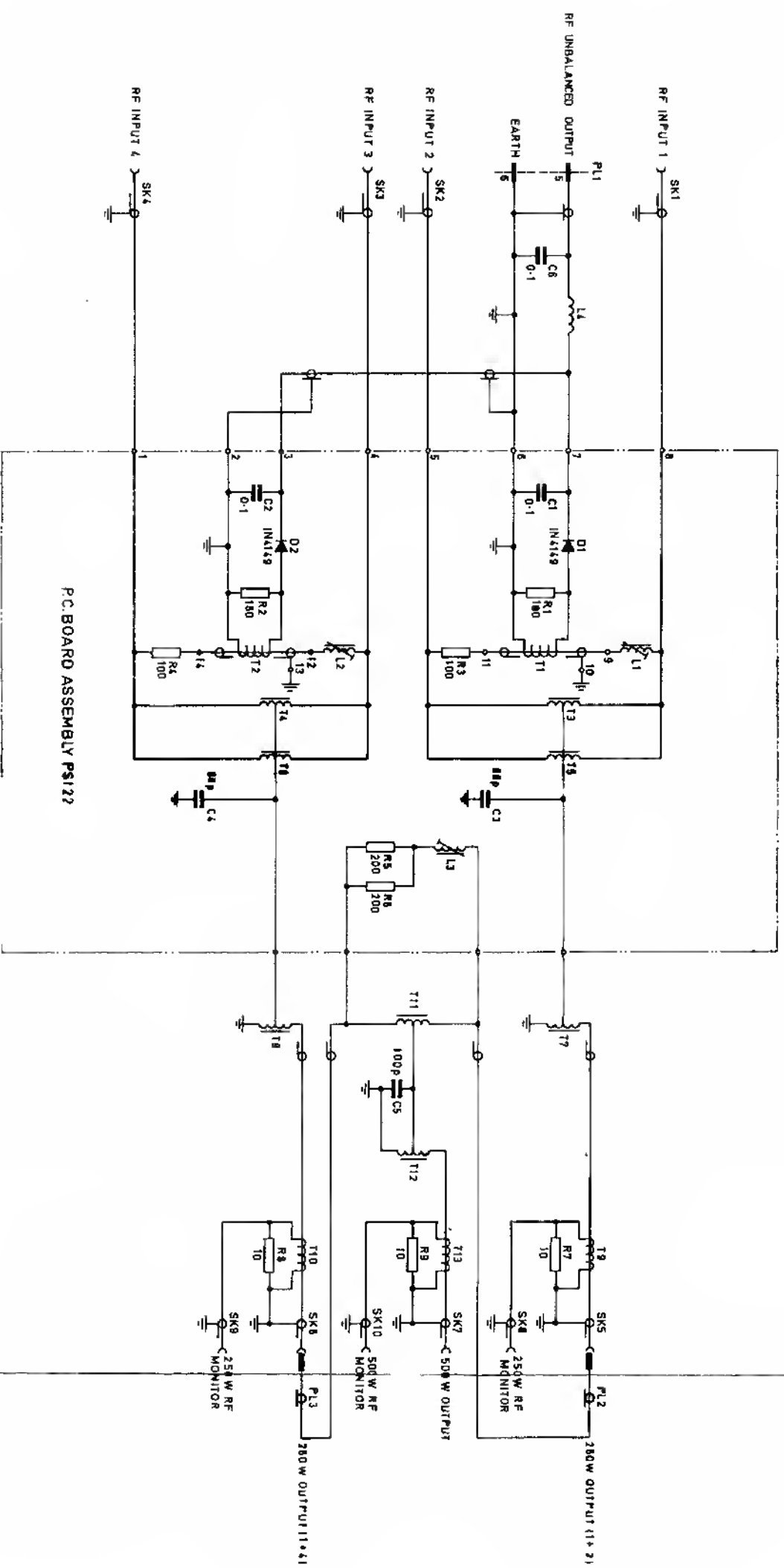
Circuit: Interconnections R.F. Module MM320



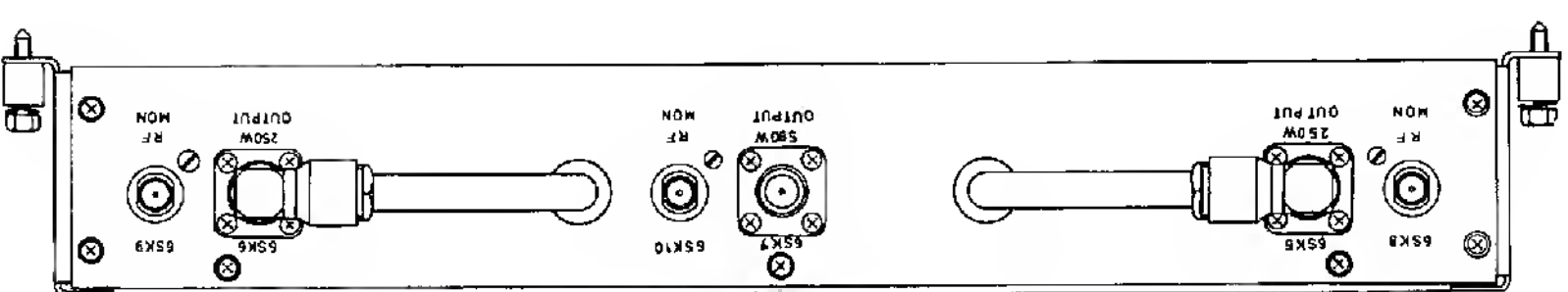
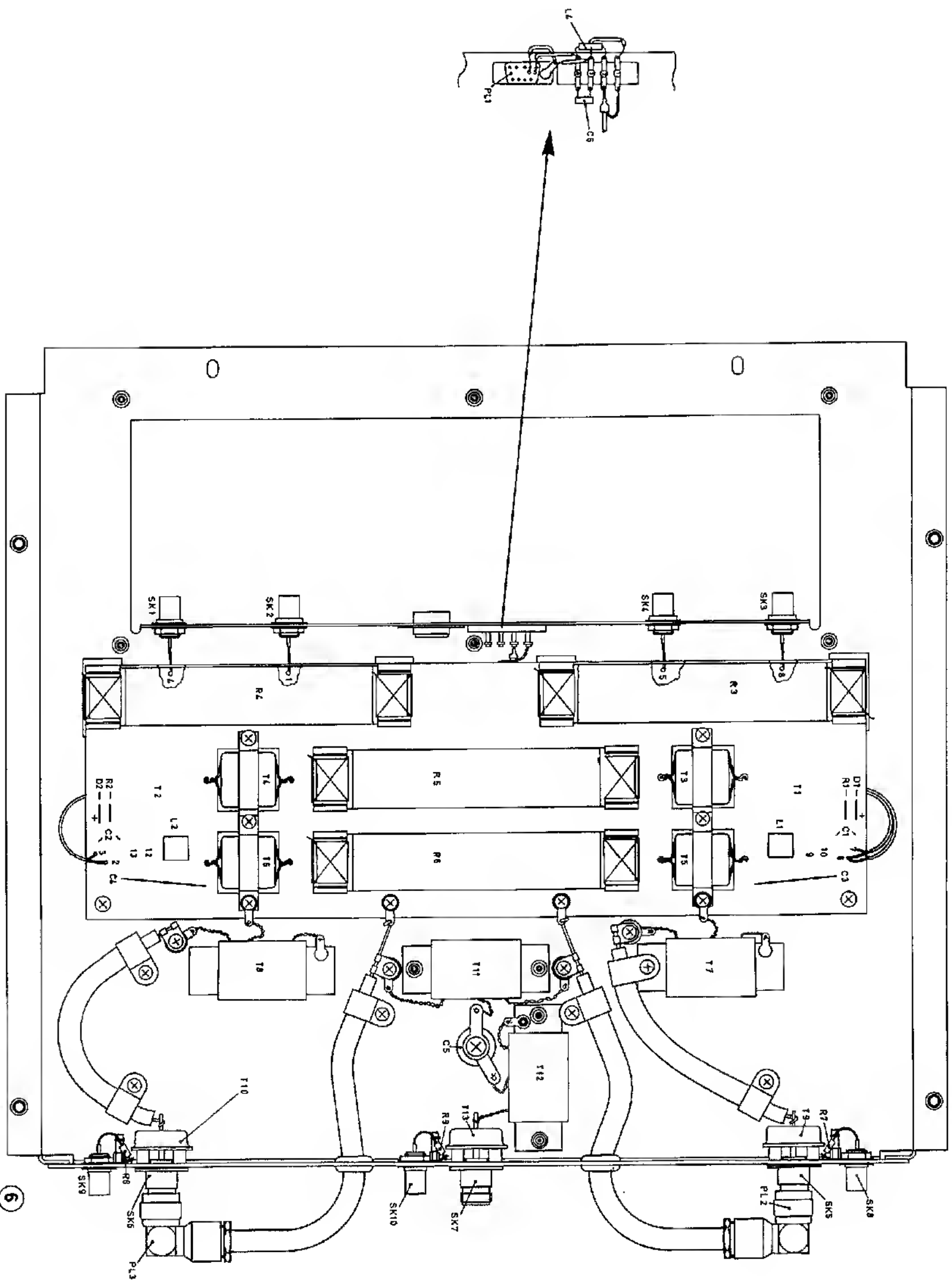
RF Power Module MM420
Sub-Unit Location

WOH4083

Fig. 22

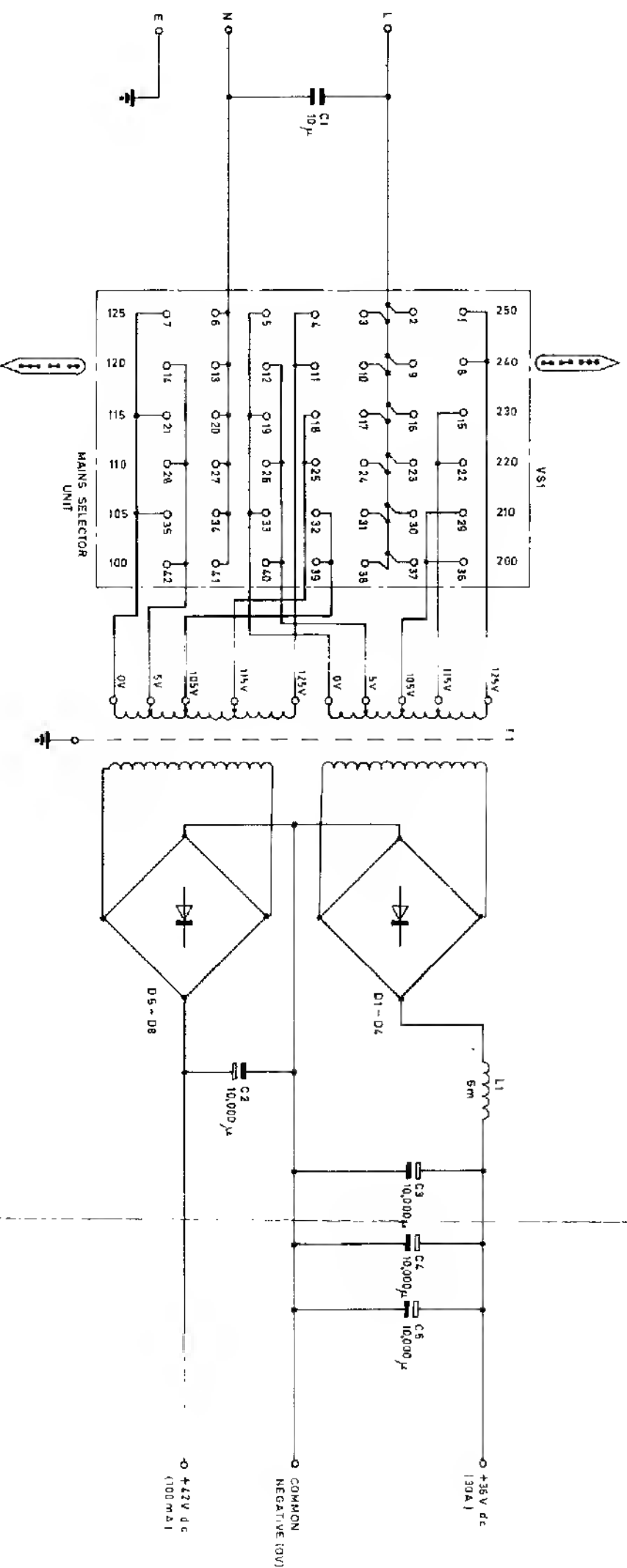


Circuit : Combining Unit MS. 126 (500 W)



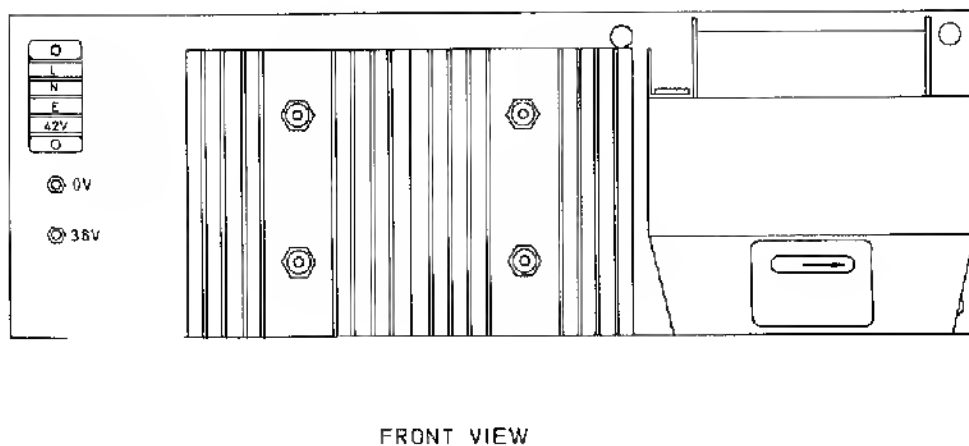
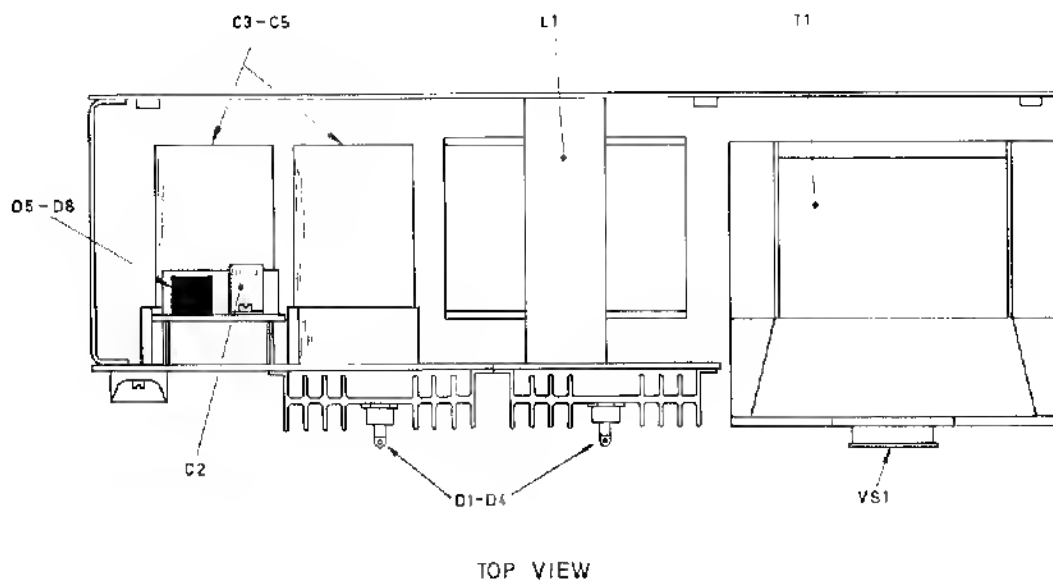
Component Layout : Combining Unit MS126

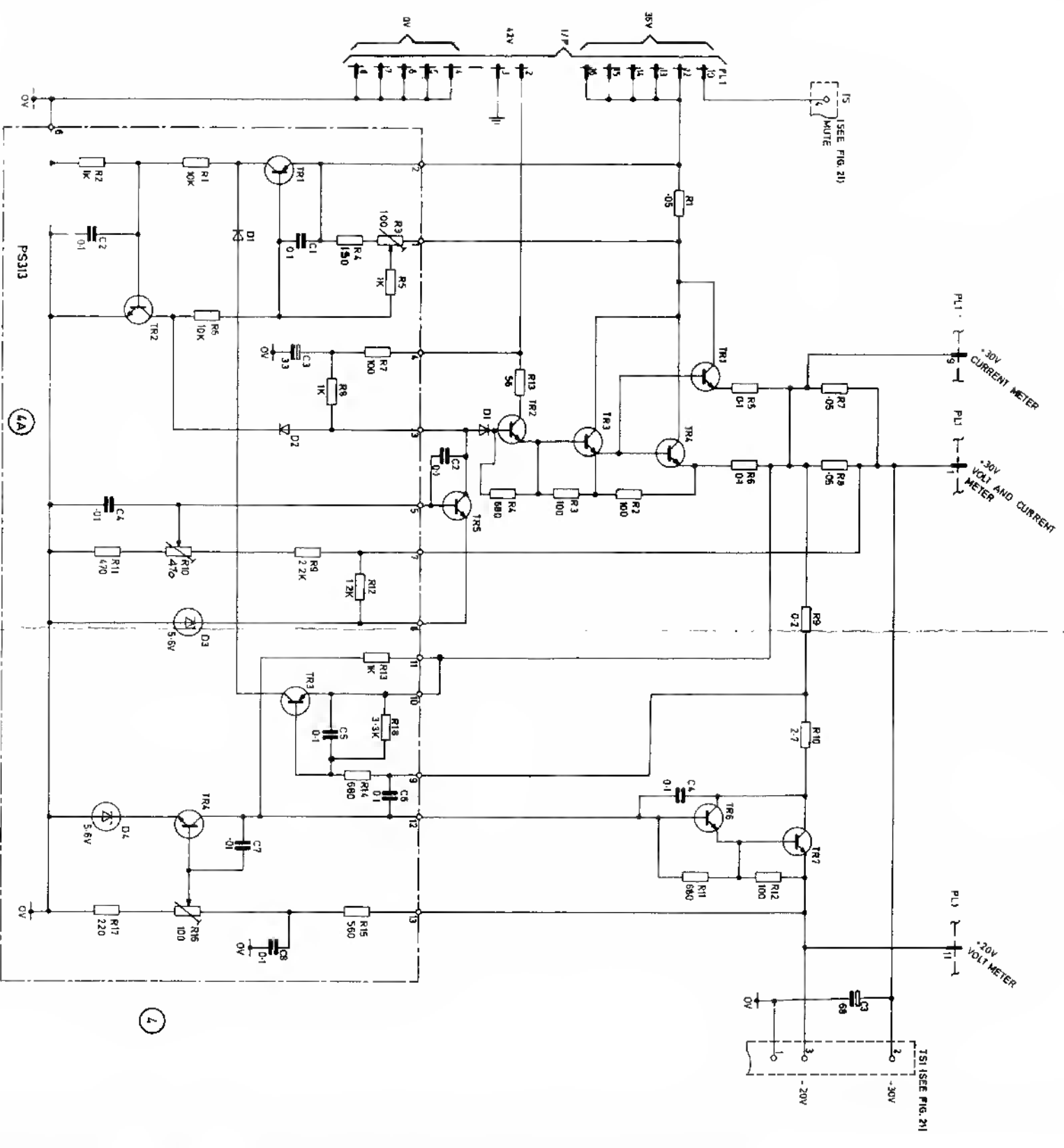
Fig.24



Circuit: Power Supply Unit MS64

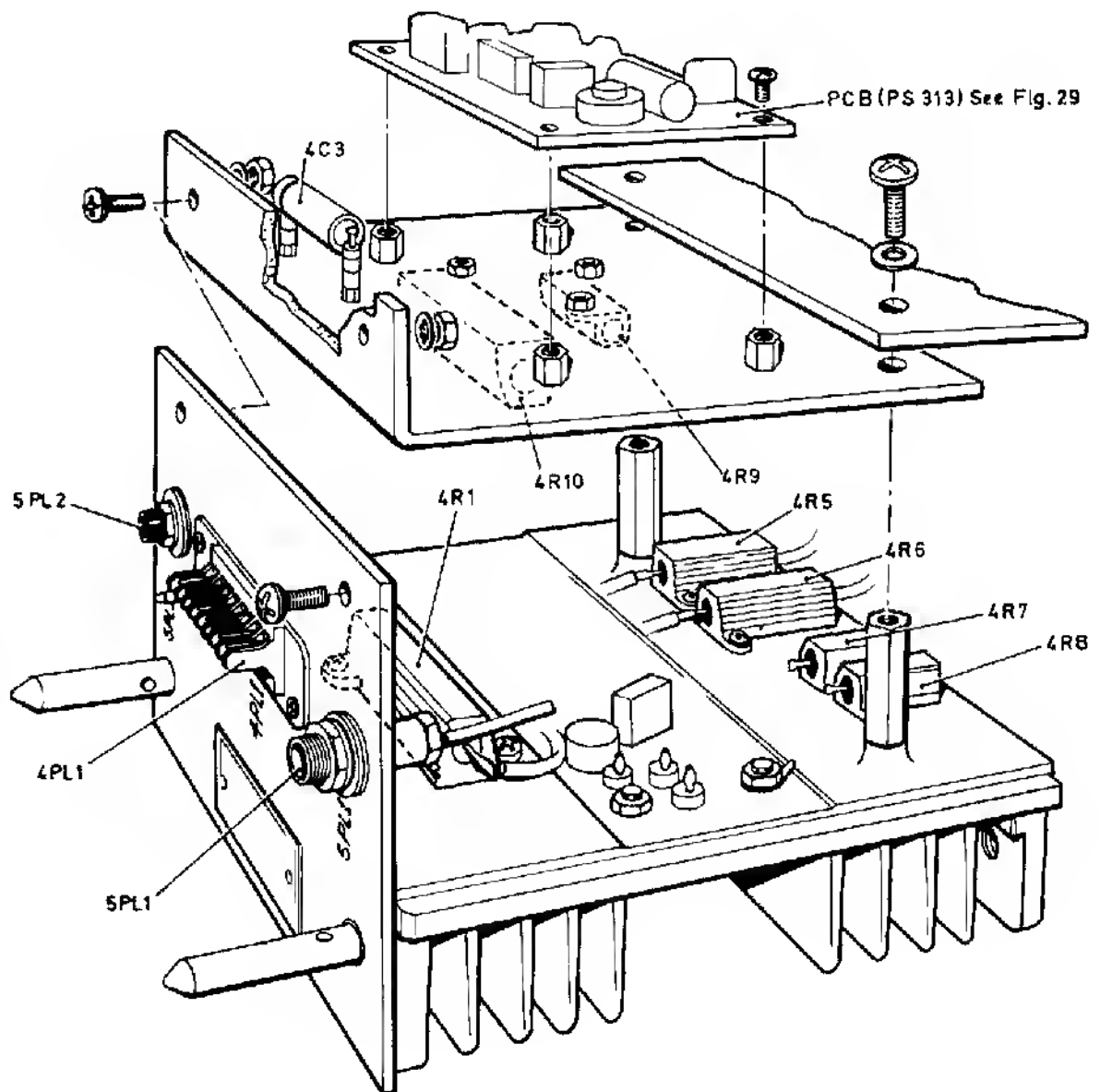
Fig. 25





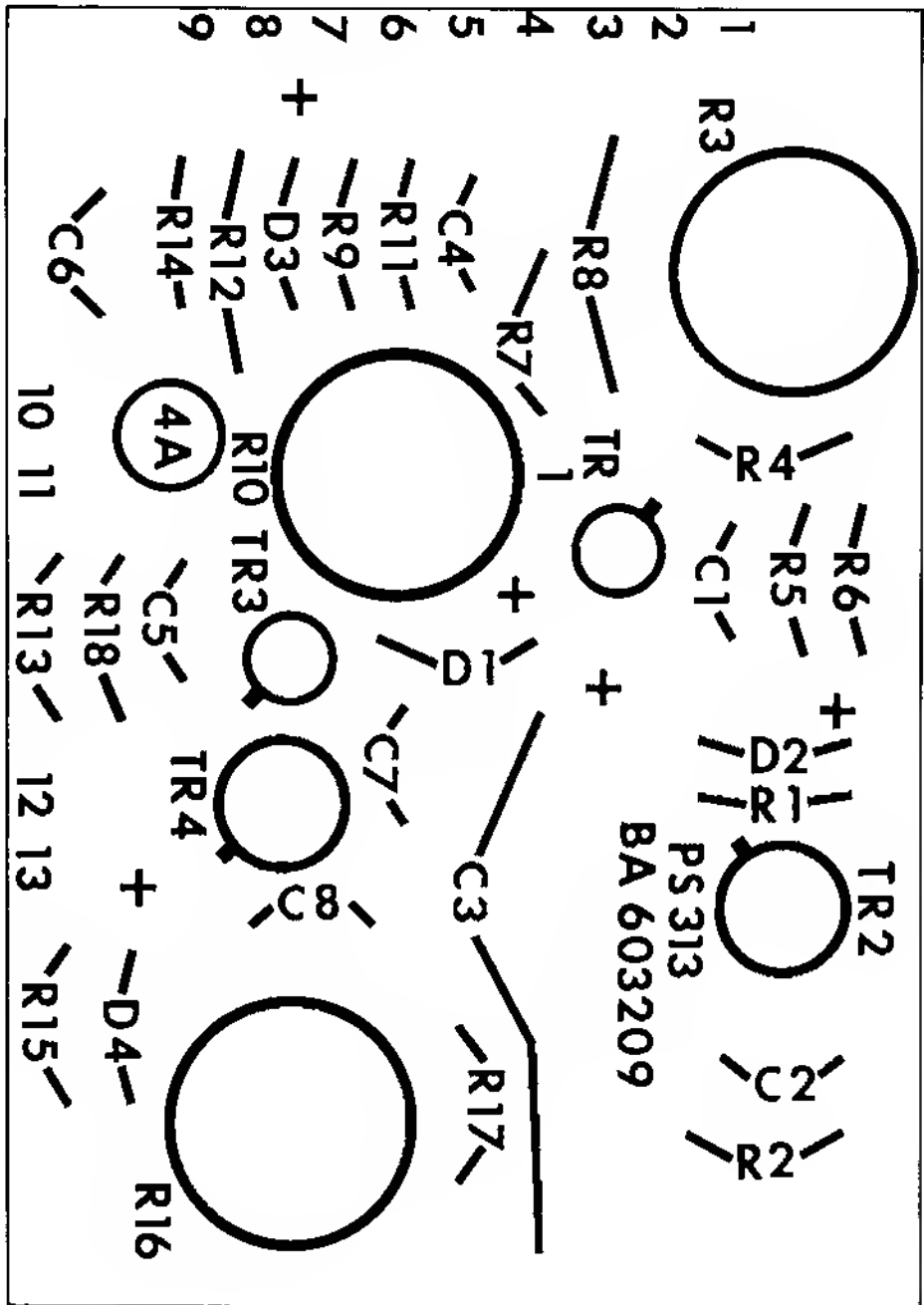
Circuit : Stabilizer Module MS440

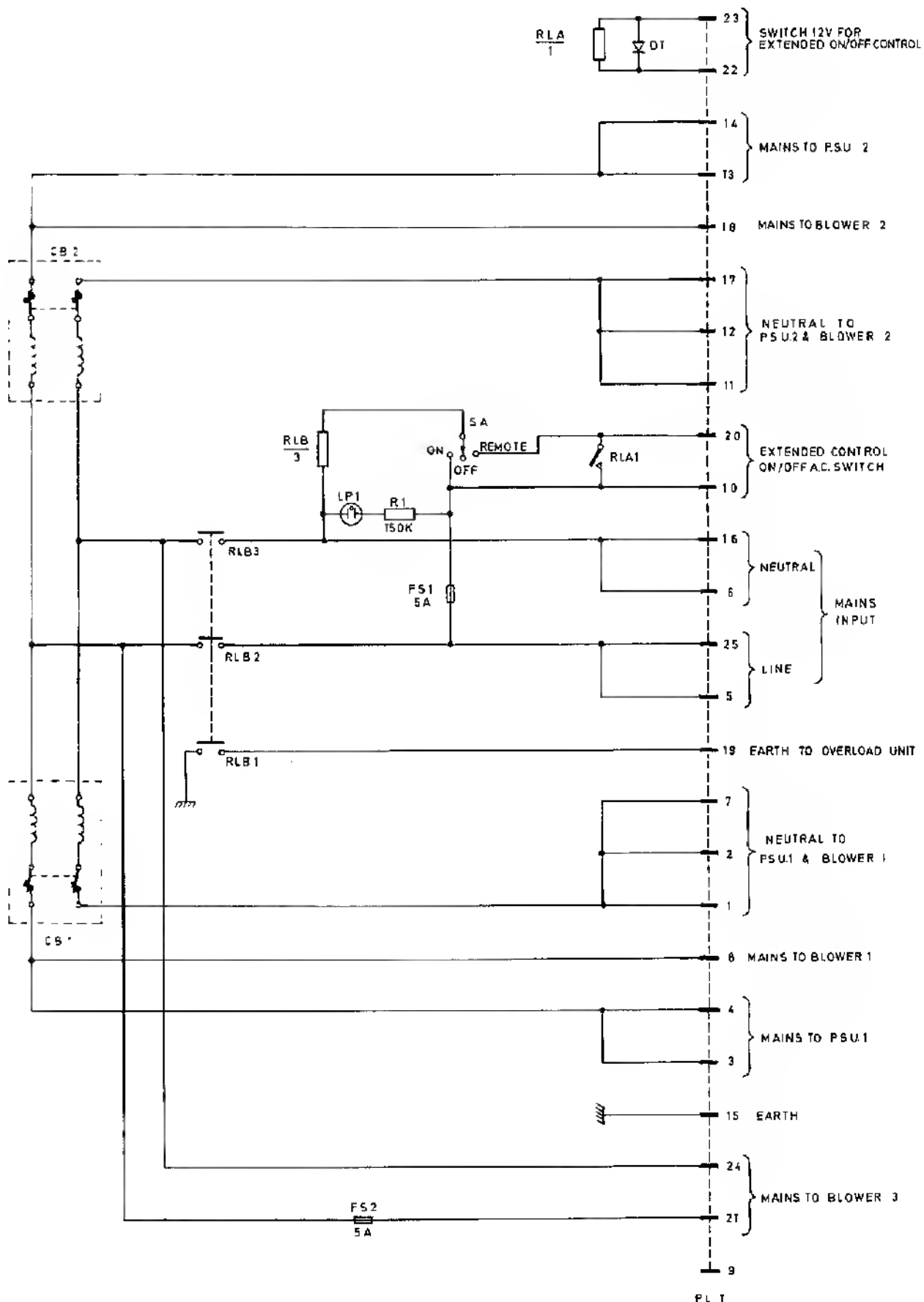
Fig 27



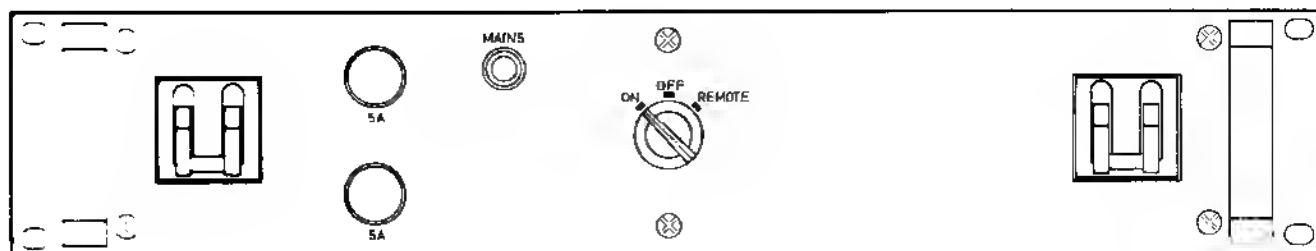
Component Layout
Stabilizer Module MS440

Fig. 28

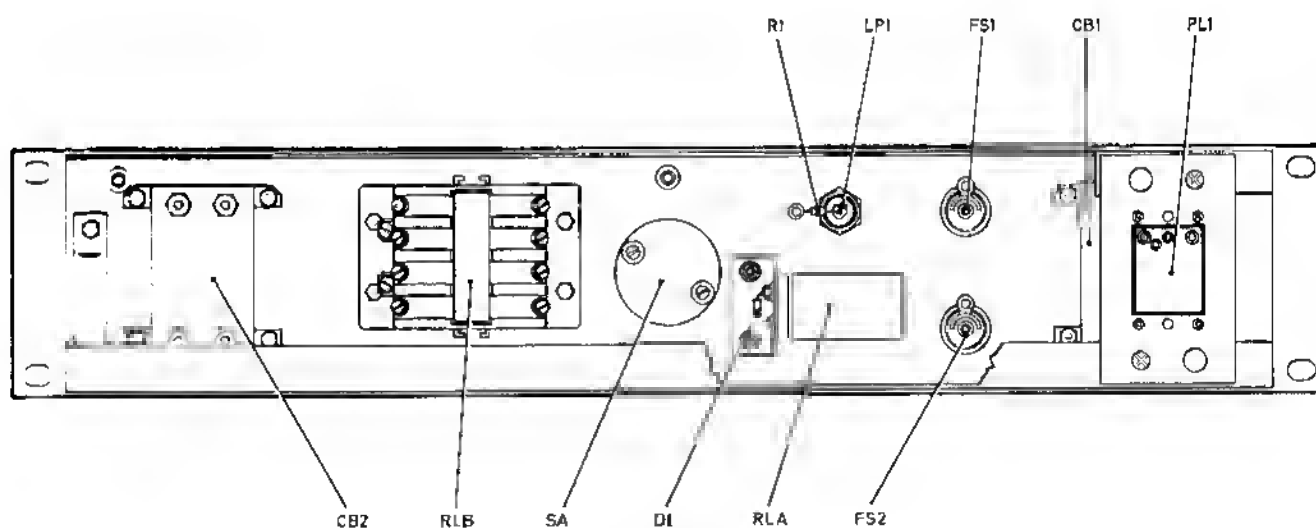




②



FRONT VIEW



REAR VIEW

Overall Interconnecting Diagram: TA 1813

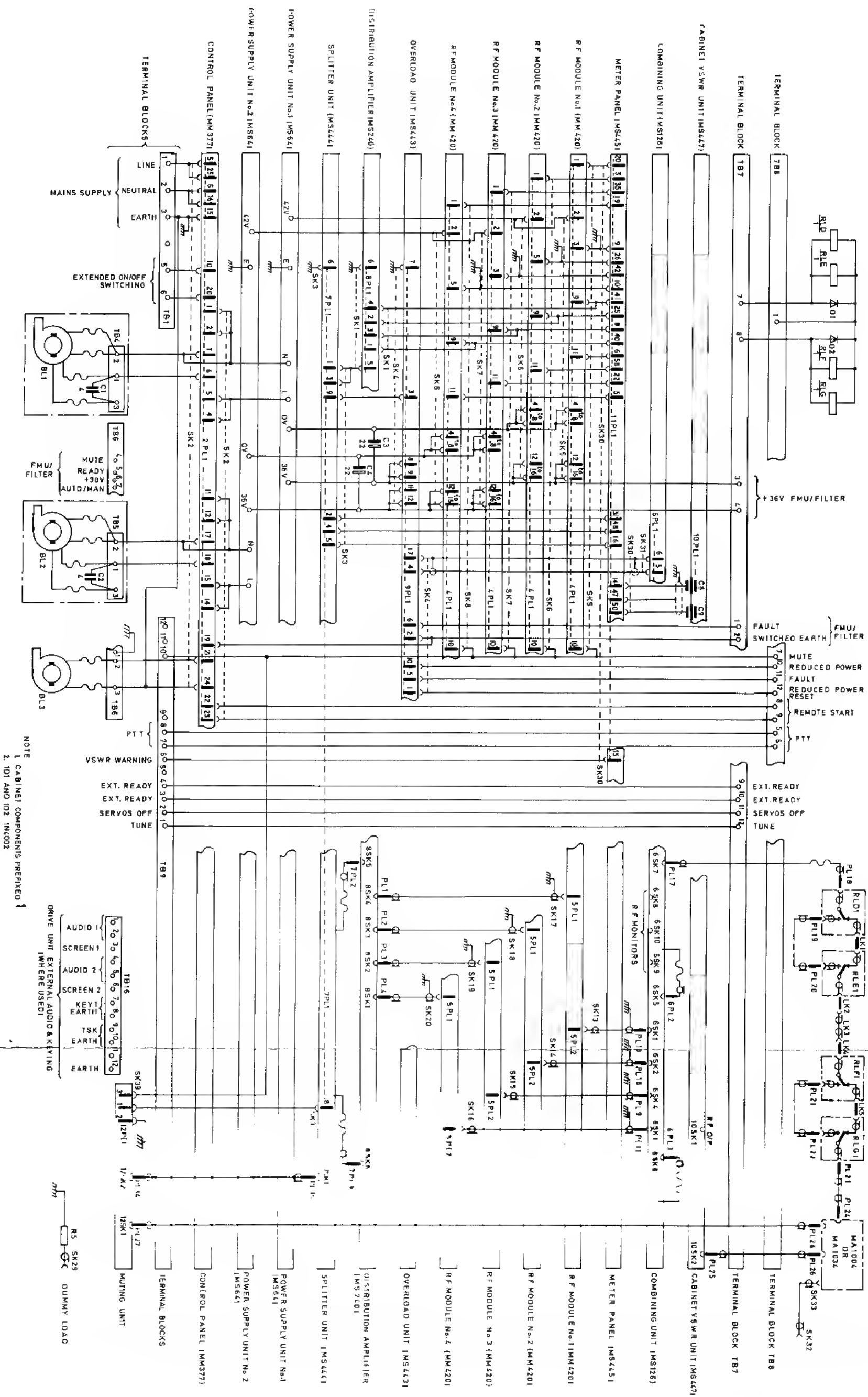
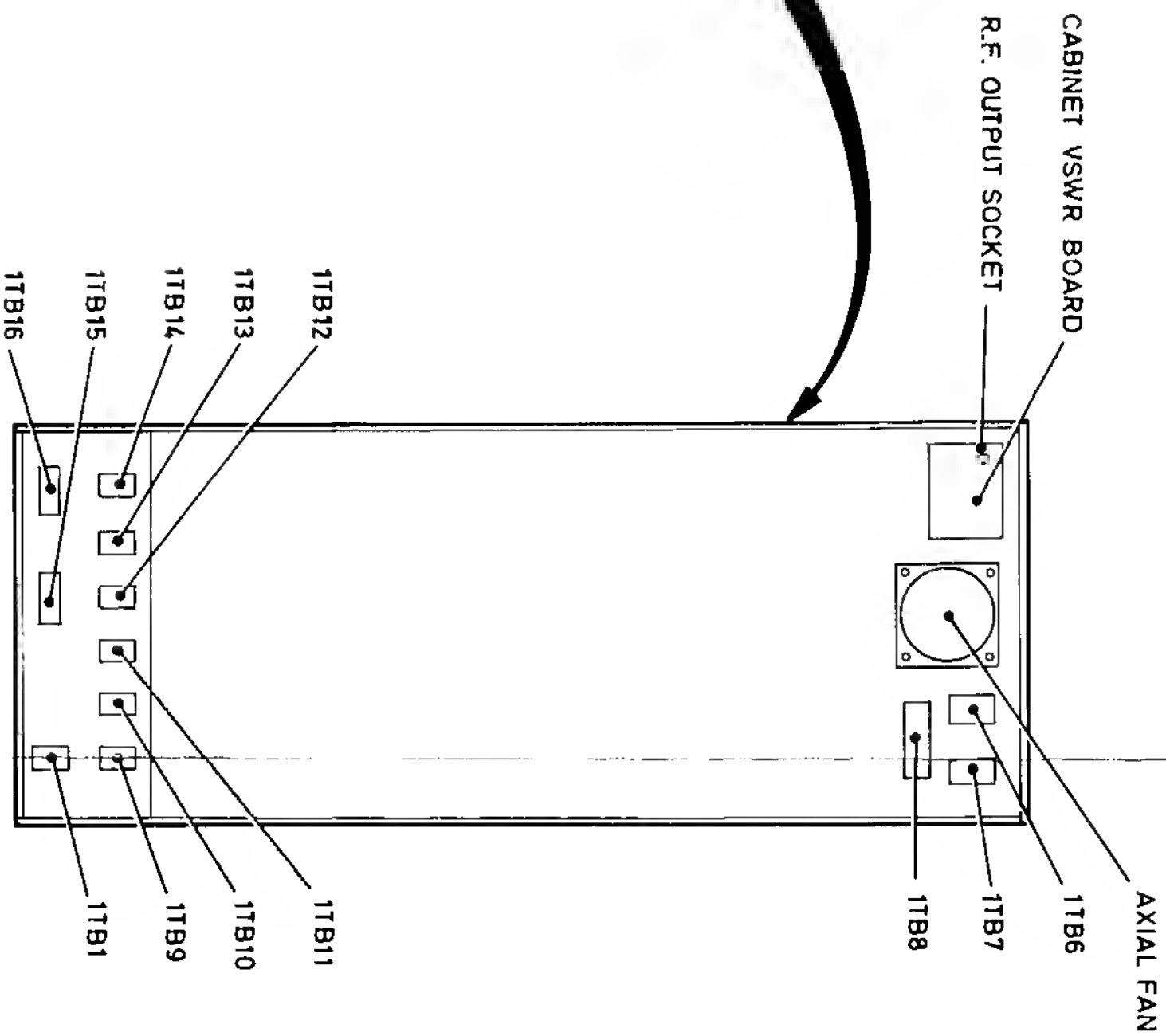
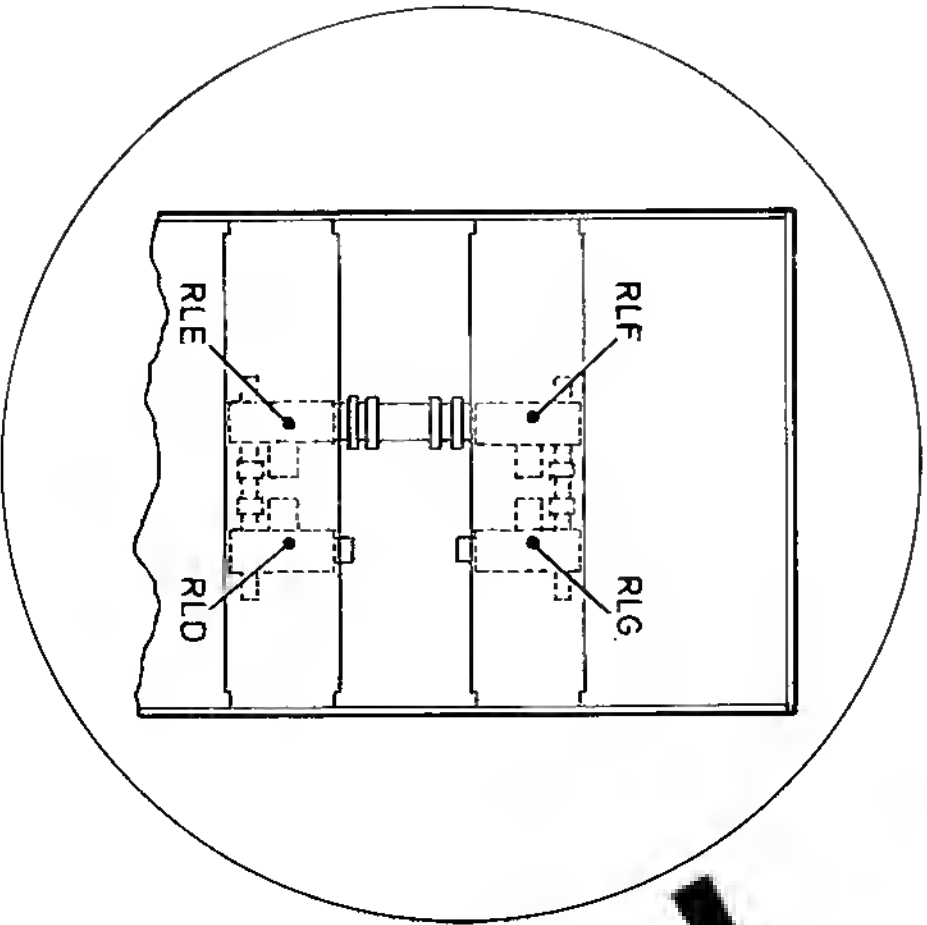
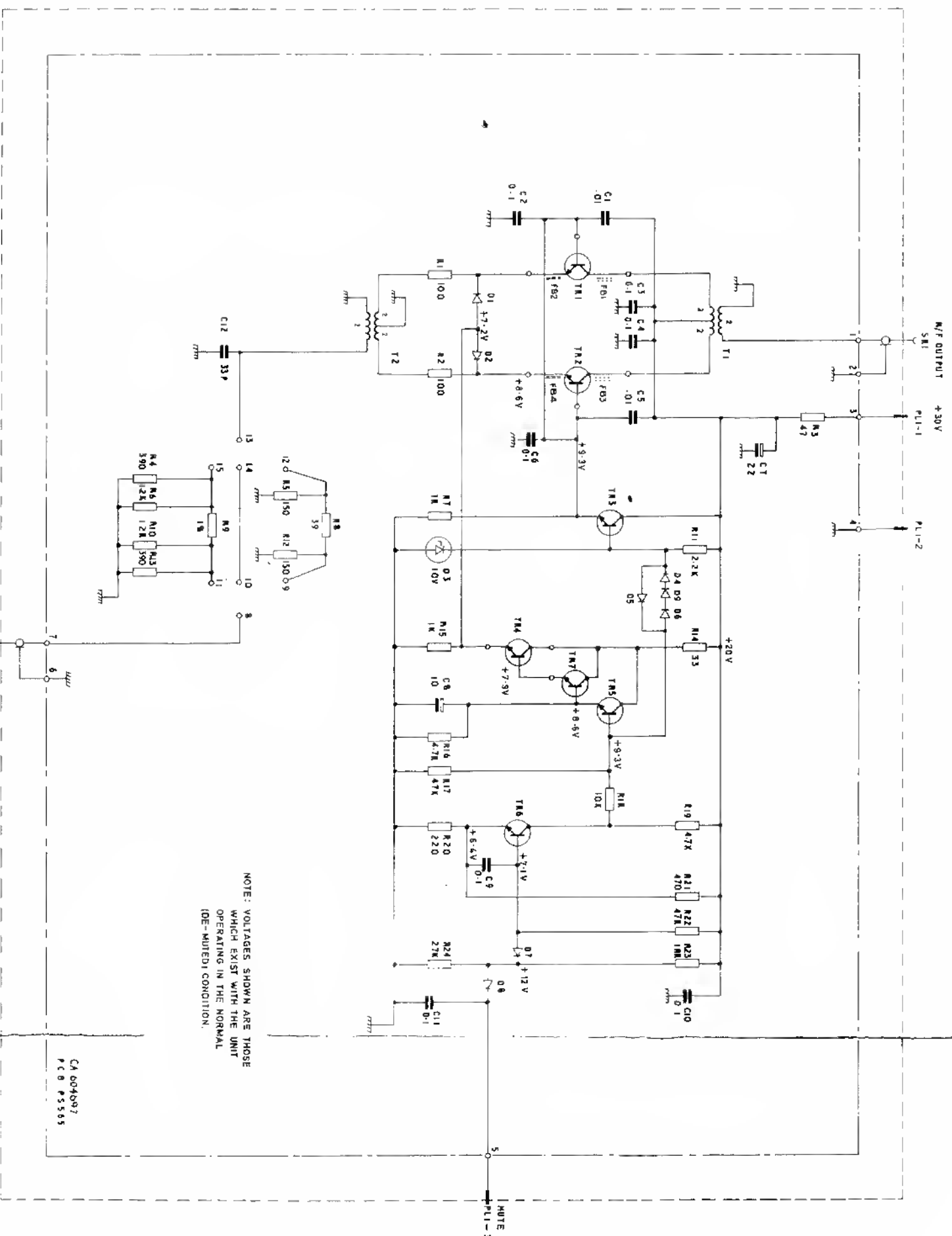
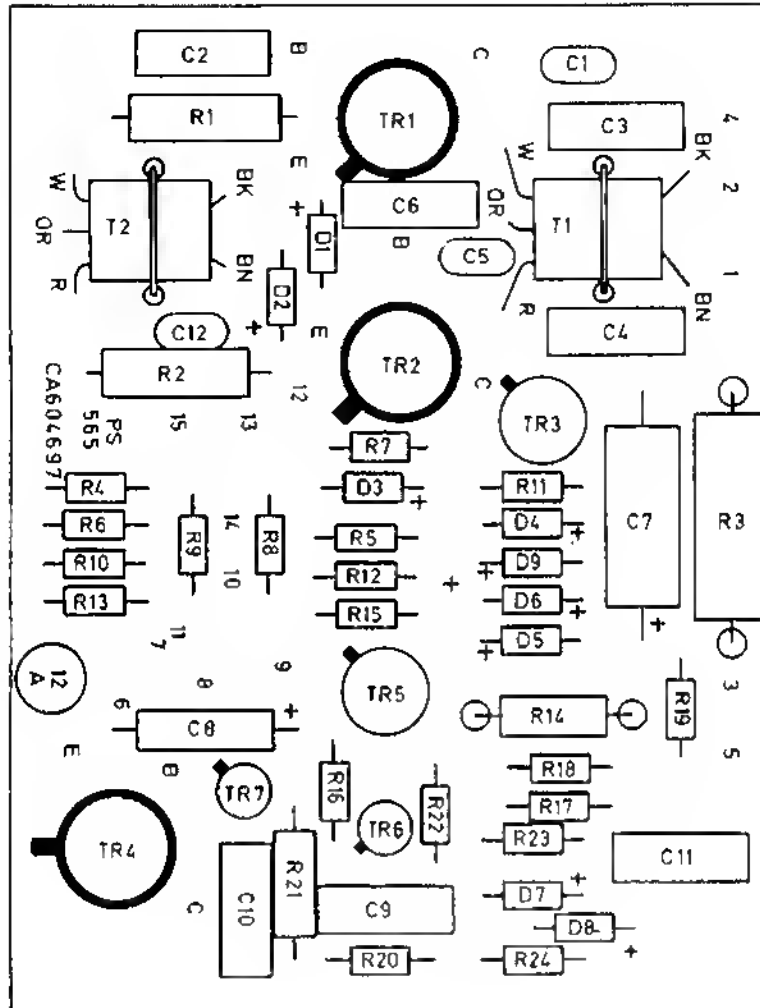


Fig.32





Circuit: Muting Unit MS564



Component Layout: Muting Unit

RACAL COMMUNICATIONS LIMITED, BRACKNELL

AMENDMENT TO

500W LINEAR AMPLIFIER TYPE TA.1813

Components List

Page 8-10 Cabinet VSWR Unit

Amend Capacitor C4 to read 120 pF, Part No. 902236

Page 8-12 RF Power Module - MM420 Chassis

Delete resistor 5R4 - not used

Delete capacitor 5C4 - not used

Add diodes 5D2 and 5D3 to read Type IN4002 Part No. 911460, Texas

Add transformer 5T3, Part No. CT 604968 Manufacturer Racal

Page 8-24 Protection Board PS 251

Amend Resistor 5CR2 to read 1k, Part No. 908267

Page 8-31 Muting Unit

Amend resistor 12AR23, 18k, to read Part No. 908272

Page 8-32 Muting Unit

Amend capacitor 12AC1 to read 0.01 μ F

Amend capacitor 12AC5 to read 0.01 μ F

Amend capacitor 12AC12 to read 33p

ILLUSTRATIONS

Fig 7: Circuit: VSWR Unit MS447

Amend capacitor C4 to read 120p

Fig. 19

Circuit: Protection PSB PS.251

Amend R2 to read 1k

Fig. 21:

Circuit Interconnection RF Module MM320

Add diodes 5D2 and 5D3 with transformer 5T3 as shown in following diagram:-

(5)

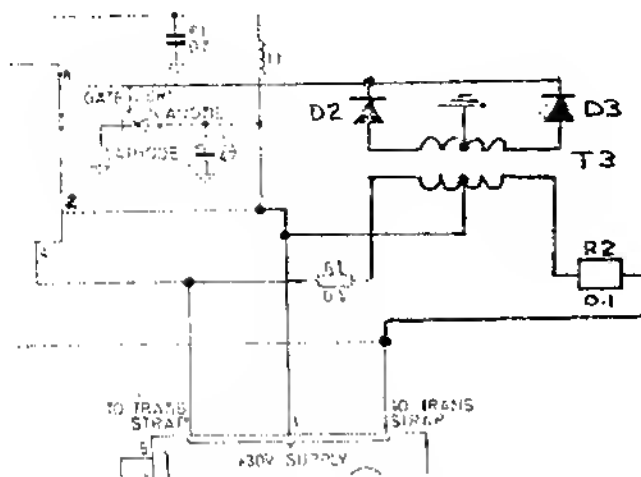


Fig. 32

Overall Interconnecting Diagram:

Ref: muting unit (located lower right-hand side)

Amend 12SK2 to read 12 SK1 mating with PL34

Amend 12SK1 to read 12SK2 mating with PL27

Fig. 34

Muting Unit MS564

Delete reference to co-axial socket Sk1 (RF Output) and earth connection to pin 2 on PCB (PS 565)

Insert wire connection from Sk1 to pin 1 on same PCB.

Fig. 35

Component layout: Muting Unit

Delete \oplus sign located between R12 and D6 on board.

RACAL COMMUNICATIONS LIMITED, BRACKNELL

AMENDMENT TO

TA. 1813 500W LINEAR AMPLIFIER

CHAPTER 4 Page 4-1 Para. 6

Amend sentence, line two, to read: 'The unit also provides a 'fault' signal if there is either a total supply failure whilst the main contactor is still made or a 'fault' signal is received from an associated unit, such as the MA. 1004 Feeder Matching Unit.'

CHAPTER 5 Page 5-3 Para. 16

Amend sentence, line two, to read: 'It also provides a 'fault' signal if there is either a total supply failure whilst the main contactor is still made or a 'fault' signal is received from an associated unit, such as the MA. 1004 Feeder Matching Unit.'

COMPONENTS LIST

Page 8-14 Low Level Board.

Add resistor 5ZR30 to read 470 Ω Metal Oxide, Tol. 5%, Part No. 906019, Type Electrosil TR5.

Amend resistor 5AR32 to read 47 Ω Part No. 911930.

Page 8-15 Low Level Board.

Add resistor 5AR55 to read 3.3k, Metal Oxide, Tol. 5%, Part No. 900991, Type Electrosil TR4.

Page 8-21 High Level Board

Add capacitors 58C35 and 58C36 to read, 0.01 μ F, Disc Ceramic, Rating 250V, Tol. -20+50%, Part No. 900067, Type Erie 801/K800011.

Page 8-30 Power Supply MS.64.

Delete capacitor C1 (10 μ F) not used.

Page 8-31 Muting Unit MS.565

Delete resistor 12AR18 (10k) not used.

Page 8-32

Add Diode 12AD10 to read 1N4149, Part No. 914898, Manufacturer; STC.

ILLUSTRATIONS

Fig. 13 Low Level Board PS.351

Add resistor R55 (3.3k) between the junction of zener diode D4/TR5 emitter and the +20V supply.

Fig. 13 Continued

Amend R32 to read 47 Ω

Add resistor R30 (470 Ω) between the junction of R32/D11 and earth.

Fig. 15 High Level Board PS.315

Add capacitor C35 (0.01 μ F) between the base of transistor TR5 and +30V supply.

Add capacitor C36 (0.01 μ F) between the base of transistor TR6 and +30V supply.

Fig. 16

Capacitors C35 and C36 are mounted on existing pins adjacent to transistors TR5 and TR6 respectively.

Fig. 25 Power Supply Unit MS.64

Delete capacitor C1 (10 μ F).

Fig. 34 Muting Unit MS.564

Delete resistor R18 (10k) and replace with diode D10, cathode connection to the base of transistor TR5.

Fig. 35

Amend R18 to read D10 and add '+' sign to the end nearest transistor TR5.

TA.1813 Add to Change No. 2. Issue 8

COMPONENTS LIST

Page 8-1 8lowers

Amend TBL1 and 1BL2 to read Part No. DD603418 Racal.

Connectors

Page 8-2

Amend connectors 1PL1, 1PL2, 1PL3, 1PL4, 1PL9, 1PL11, 1PL13, 1PL15 and 1PL27, together with,

Page 8-5

Amend connectors 7PL2 and 7PL3 to read as follows:-

Coaxial 50 ohm, Part No. 923981, Type Radioll R141082.

Add to each of the above connectors a note to read: 'Add Adaptor-Elbow, Part No. 924736, Type Radioll R141770.